ELECTRICAL TIMES

THURSDAY
11 OCT.
1951
NINEPENCE

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FG97a

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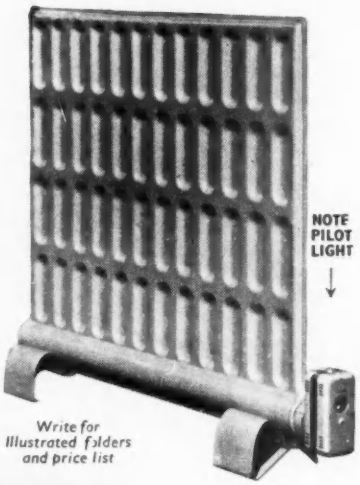

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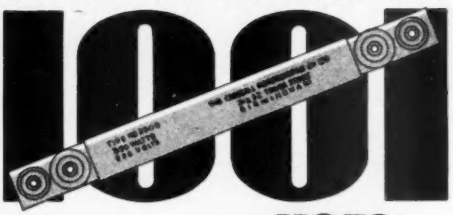

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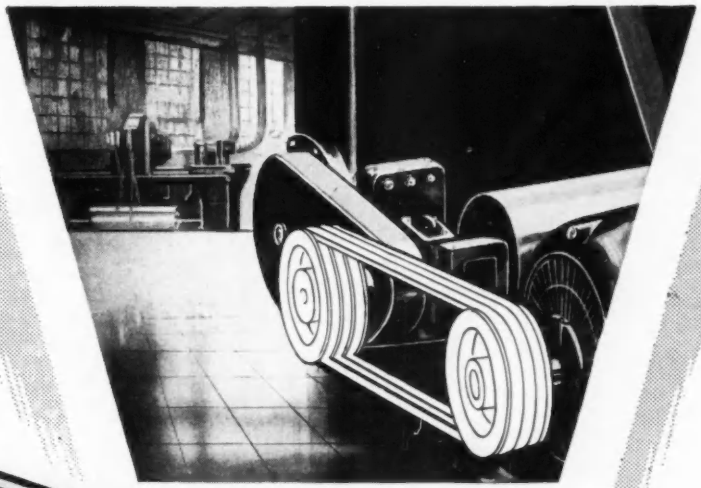
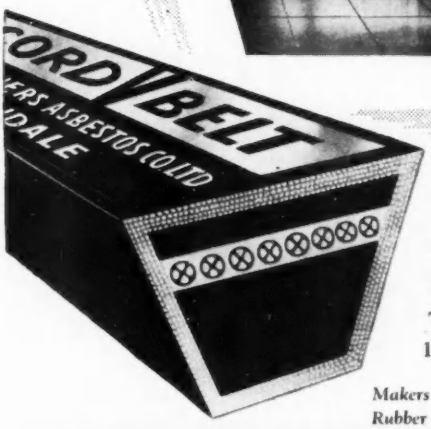
serve the ENGINEERING INDUSTRY





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V18

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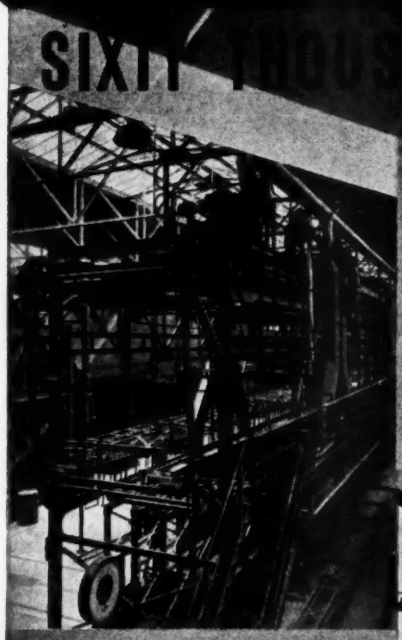

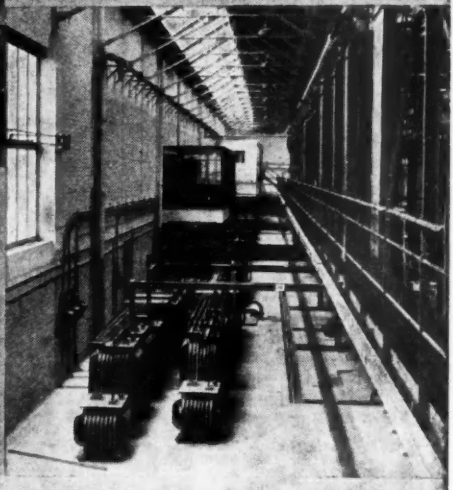

is designed for an output of 150 tons of window frames of widely varying types and sizes per 48 hour week, totalling 112,000 square feet with an average thickness of deposition of .0005 inches. "Westalite" rectifiers supply power for the three electrolytic processes, namely Cathodic Pickle and Anodic Pickle 15,000 amperes each, and Zinc Plating 30,000 amperes.

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WESTALITE

PLATING RECTIFIERS

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Photographs are reproduced by courtesy of Messrs. Electro Chemical Engineering Co. Ltd. of Weybridge, who carried out the complete installation.

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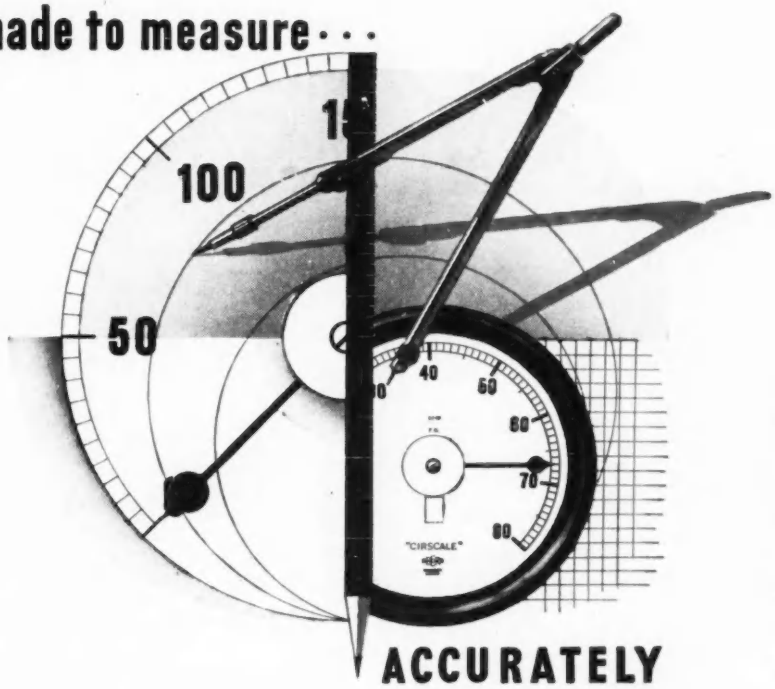

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Throughout the wide field of modern electrical engineering there are no items of apparatus more versatile and dependable.

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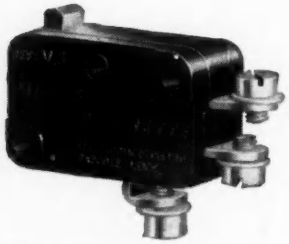

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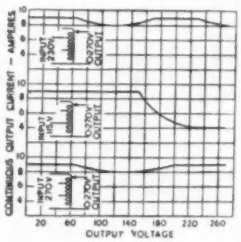
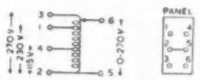
TYPE	LOAD RATING	SPECIFICATIONS				NO-LOAD LOSS	NET PRICE*
		INPUT VOLTAGE	CURRENT		OUTPUT VOLTAGE		£ s. d.
			RATED	MAXIMUM			
100-K	2000 va.	115	15 a.	17.5 a.	0-115	20 watts	17 17 0
100-KM	2000 va.	115	15 a.	17.5 a.	0-115	20 watts	18 12 0
100-L	2000 va.	230/115	8 a.	9 a.	0-230	25 watts	17 17 0
100-LM	2000 va.	230/115	8 a.	9 a.	0-230	25 watts	18 12 0
100-Q	2000 va.	115	15 a.	17.5 a.	0-135	20 watts	18 9 0
100-QM	2000 va.	115	15 a.	17.5 a.	0-135	20 watts	19 4 0
100-R	2000 va.	230/115	8 a.	9 a.	0-270	30 watts	18 9 0
100-RM	2000 va.	230/115	8 a.	9 a.	0-270	30 watts	19 4 0
100-LH	1200 va.	480/240	2 a.	2.5 a.	0-480	25 watts	21 15 0
500-L*	1450 va.	180	8 a.	9 a.	0-180	25 watts	17 17 0
2000-K†	1000 va.	125	8 a.	9 a.	0-125	25 watts	17 17 0

* *For 500 cycles* † *For 2,000 cycle service* * *All "VARIAC" prices plus 10% as from 1st June, 1951*

SERIES 100 "VARIAC" TRANSFORMERS

With a "VARIAC," voltages are instantly and minutely adjustable from O-line Voltage. On some patterns, such as 100-R, there is even an "over voltage" feature. This can provide over line voltage, or compensate for low lines. See curves and input and output connections, shown below.





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TYPE 100-R.

● *Many other suggestion on the use of "VARIAC" Transformers are contained in Catalogue V549 which will gladly be sent on request.* CL3

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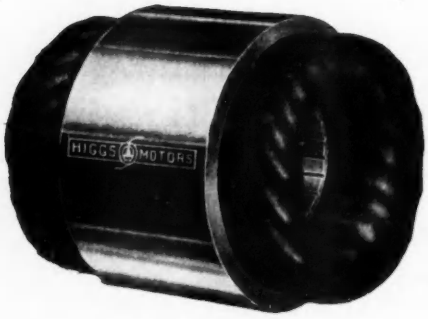

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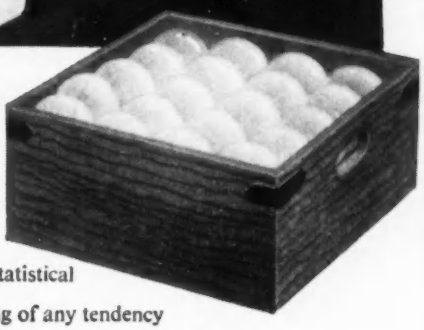

In mass production the batch number of a lamp is an important reference, as from every batch, during manufacture, a certain percentage of lamps is subjected to numerous tests. Statistical analysis of the results of these tests gives early warning of any tendency to drift from the desired standard in light output, mechanical strength, life etc. You can therefore, take any number of these lamps with the assurance of consistently high quality throughout.

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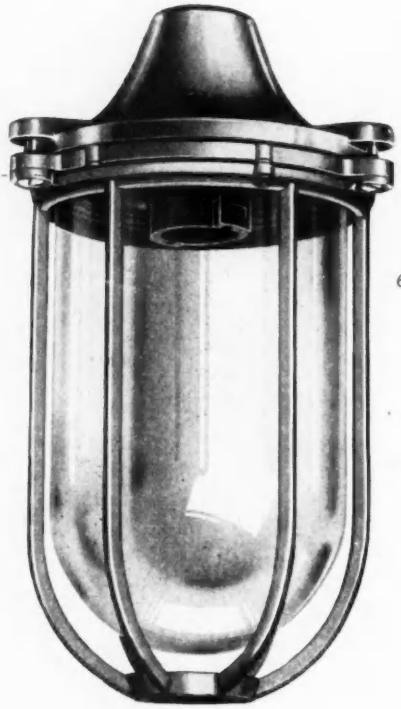

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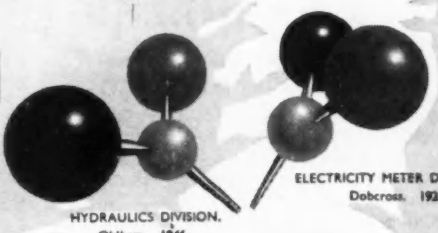

ELECTRICITY METER DIVISION, Dobcross. 1926

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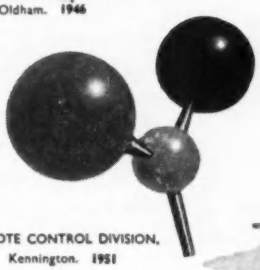

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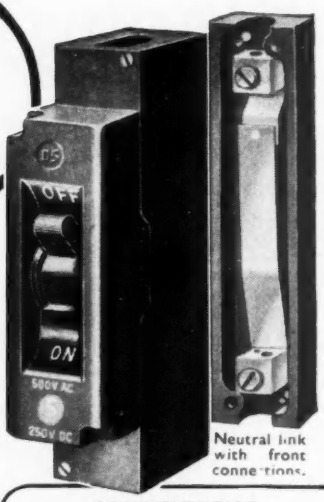

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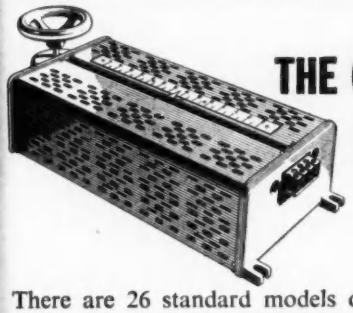

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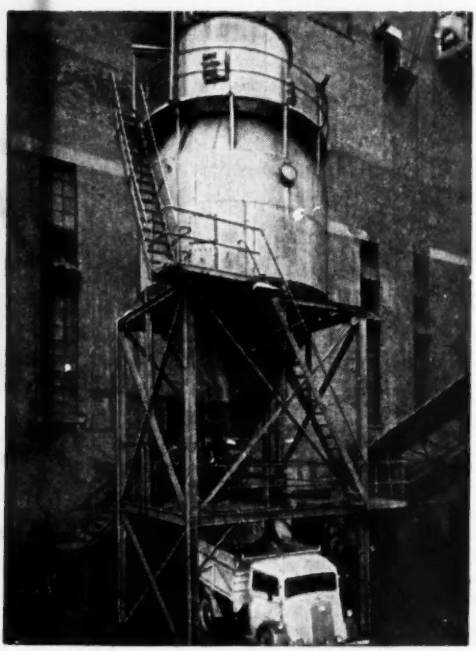

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R/52

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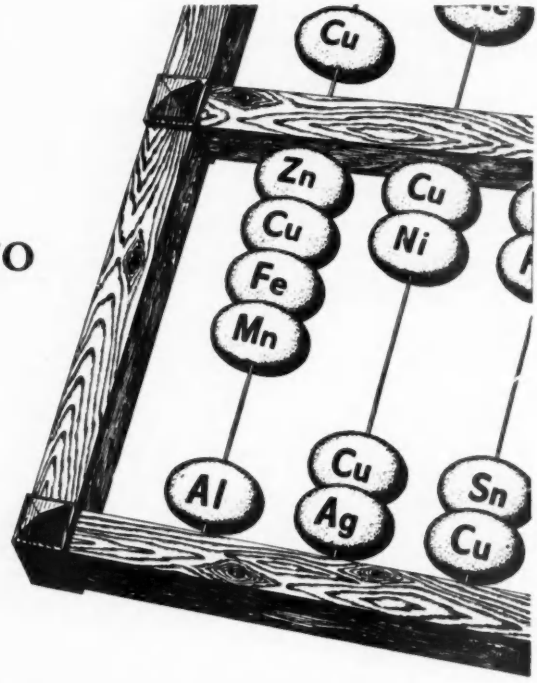

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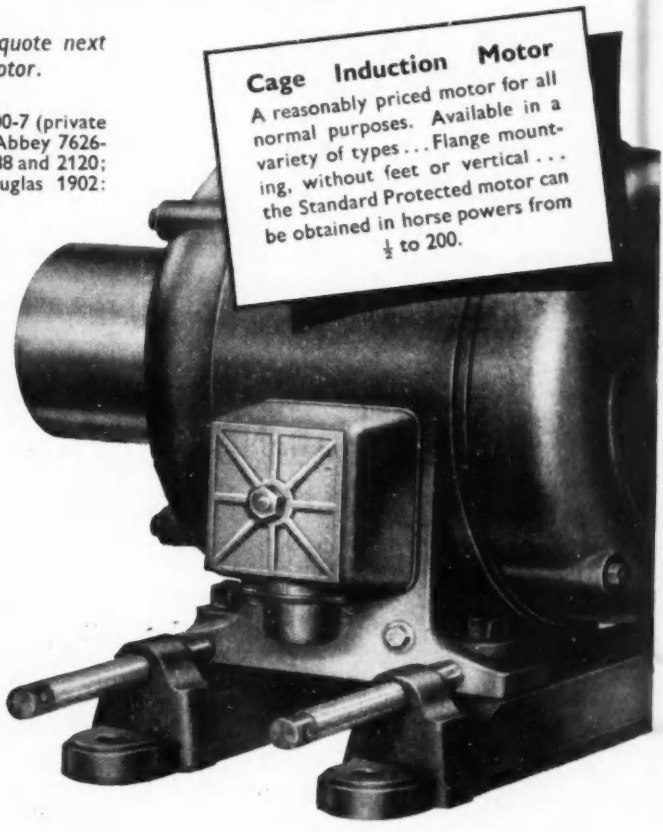

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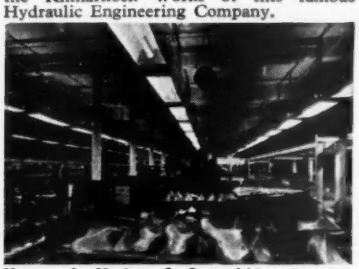

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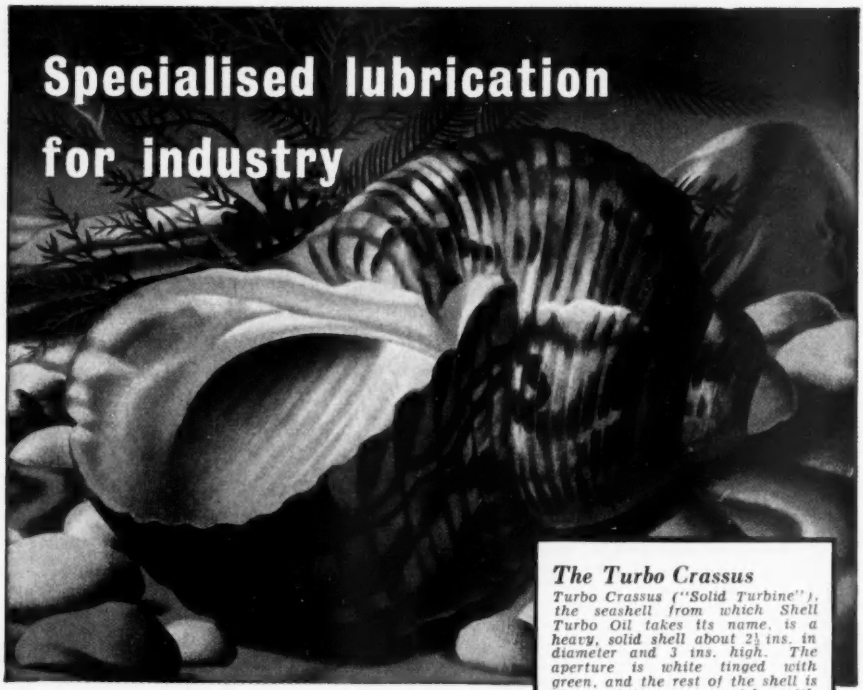

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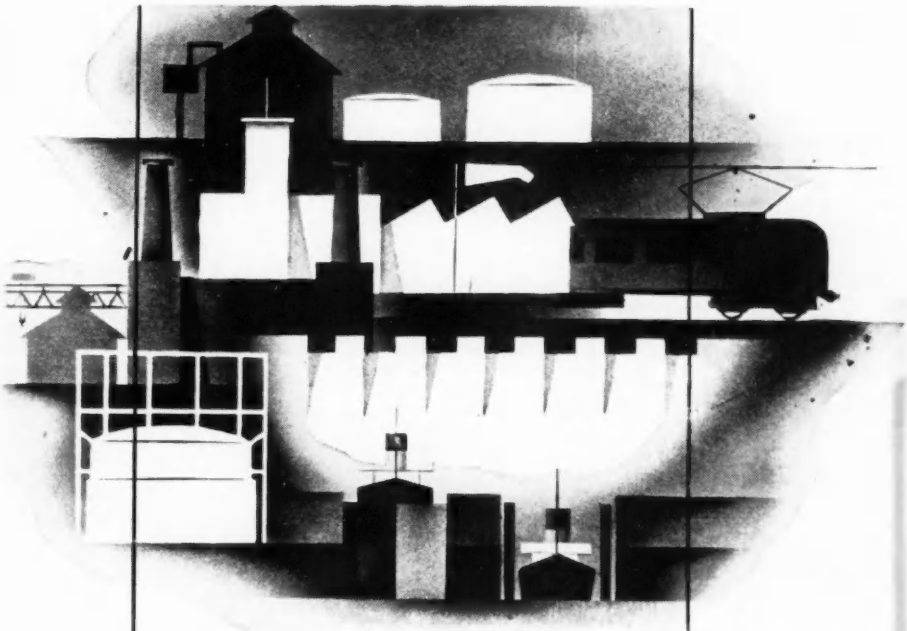

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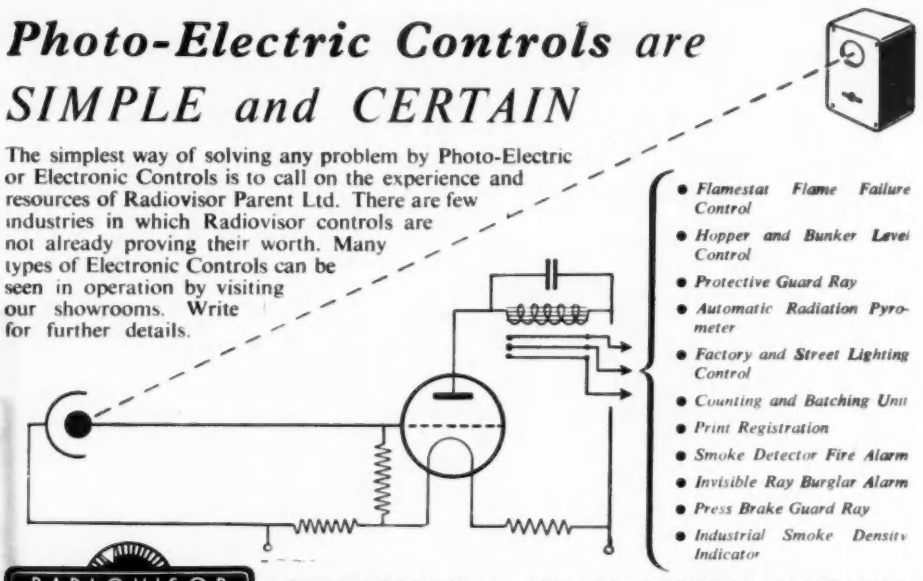

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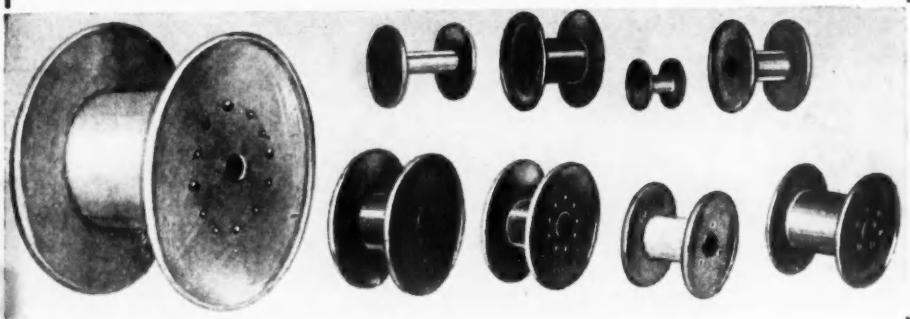

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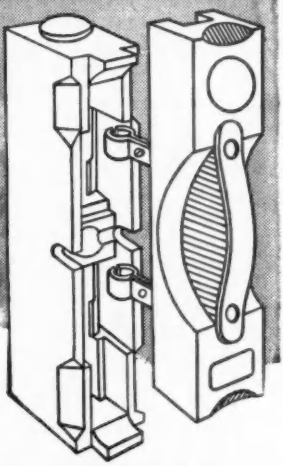

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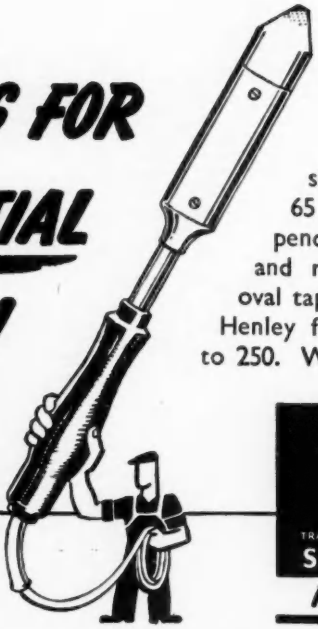

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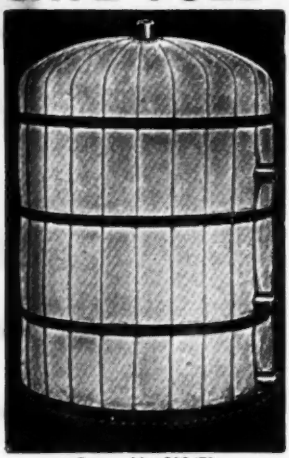

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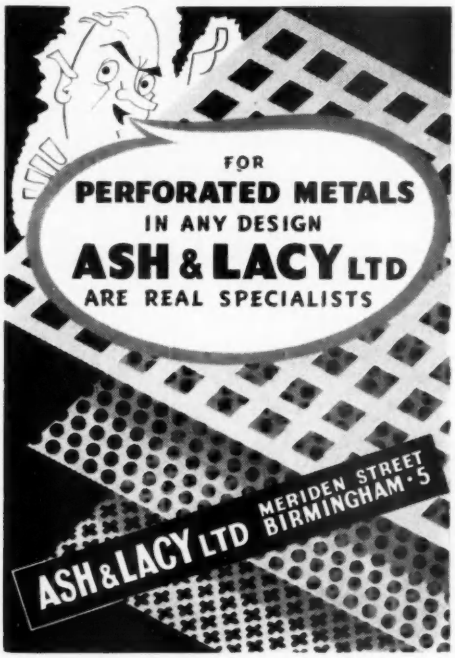

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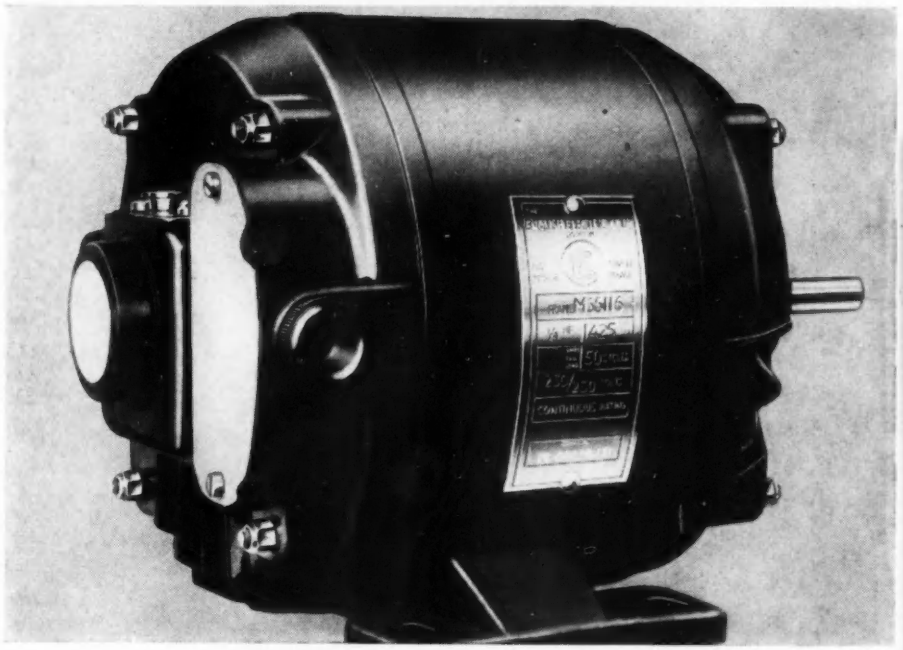

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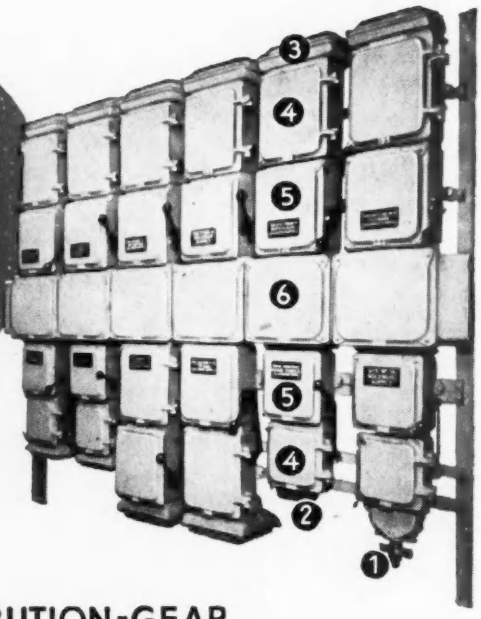

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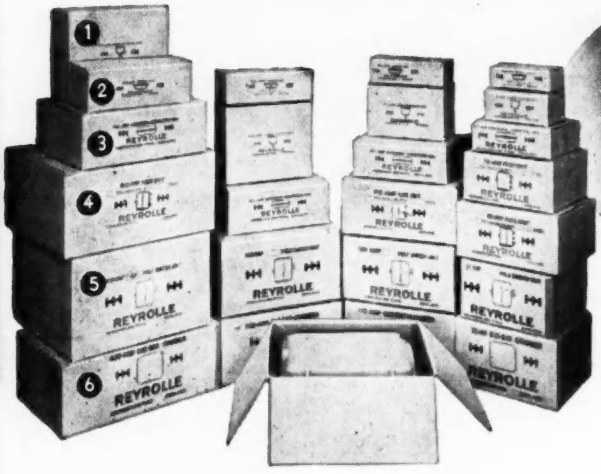

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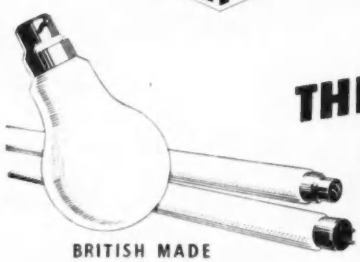

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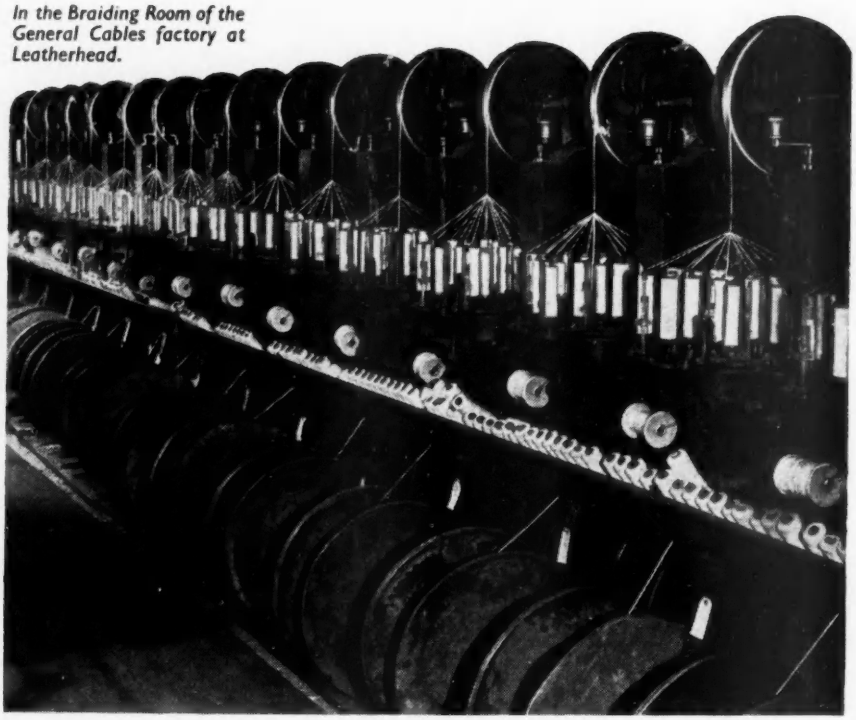

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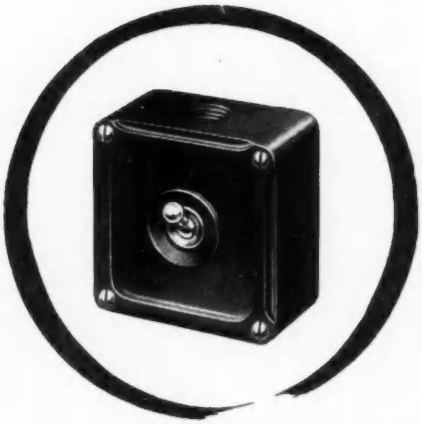

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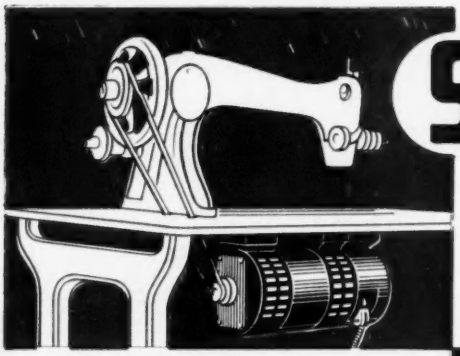

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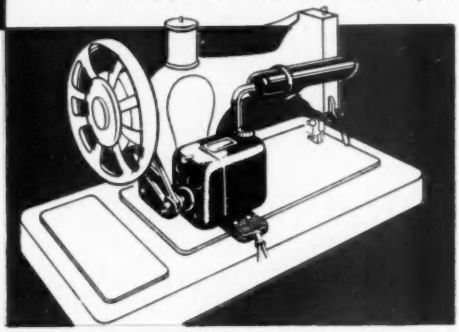

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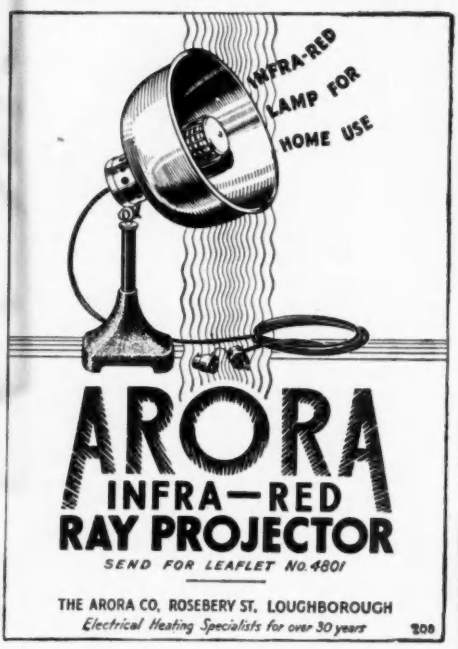

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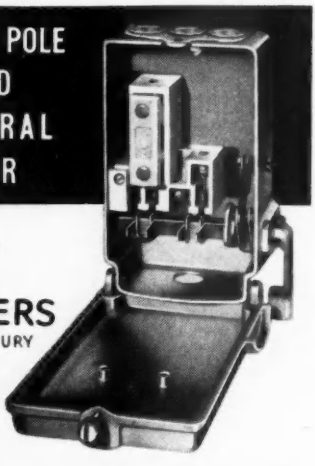

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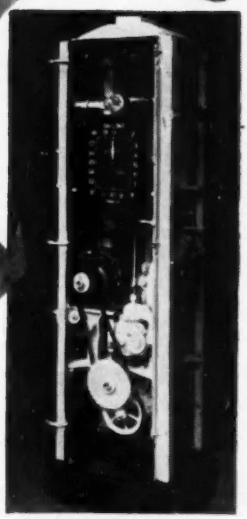
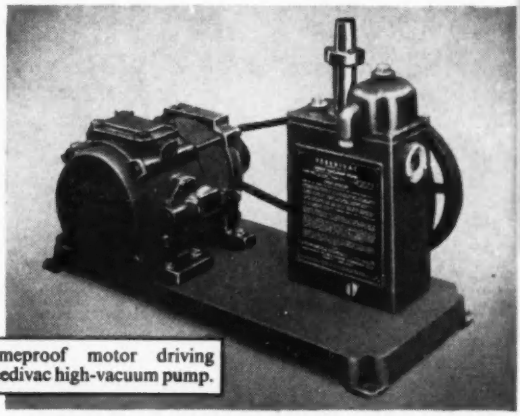


Kerbside Petrol pump (covers removed)



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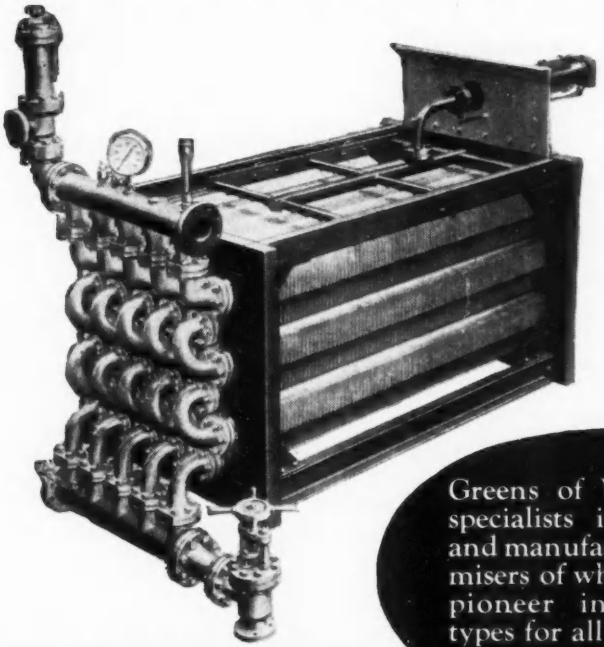

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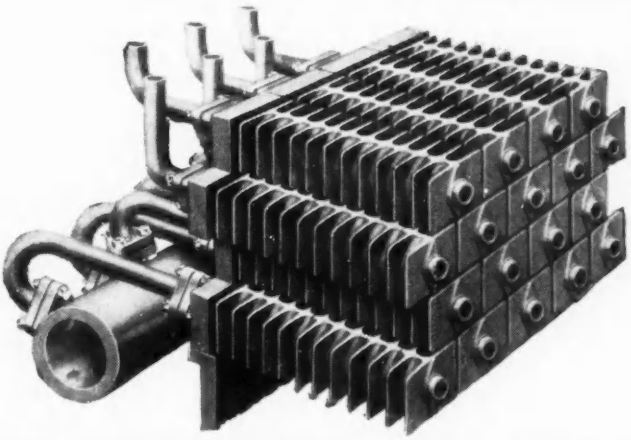

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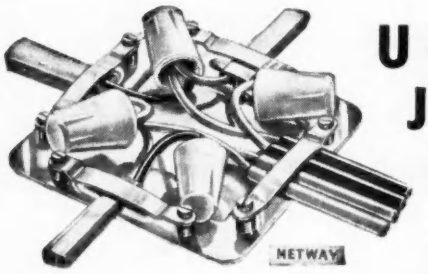

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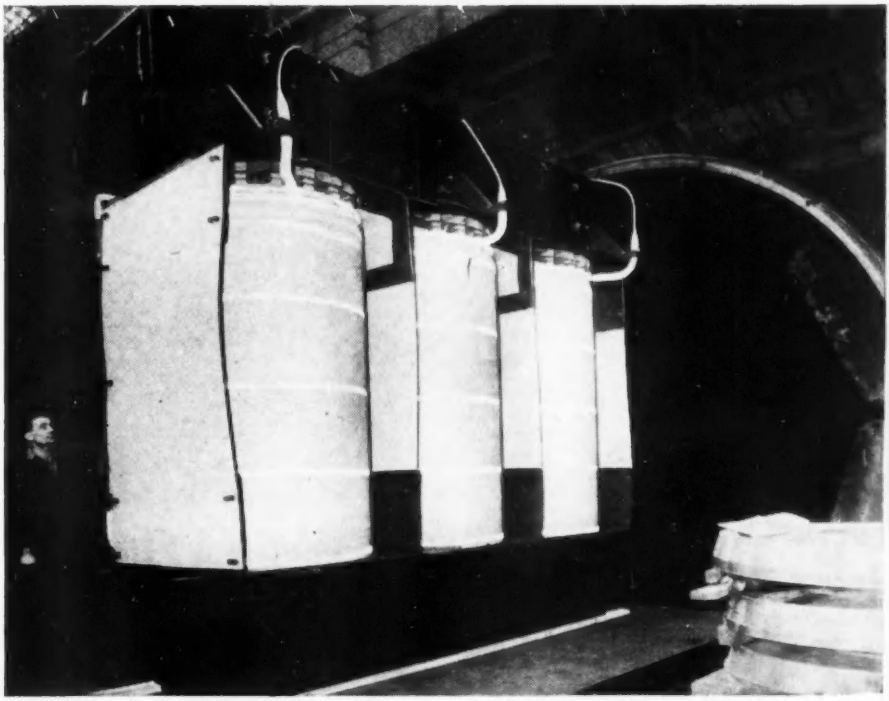

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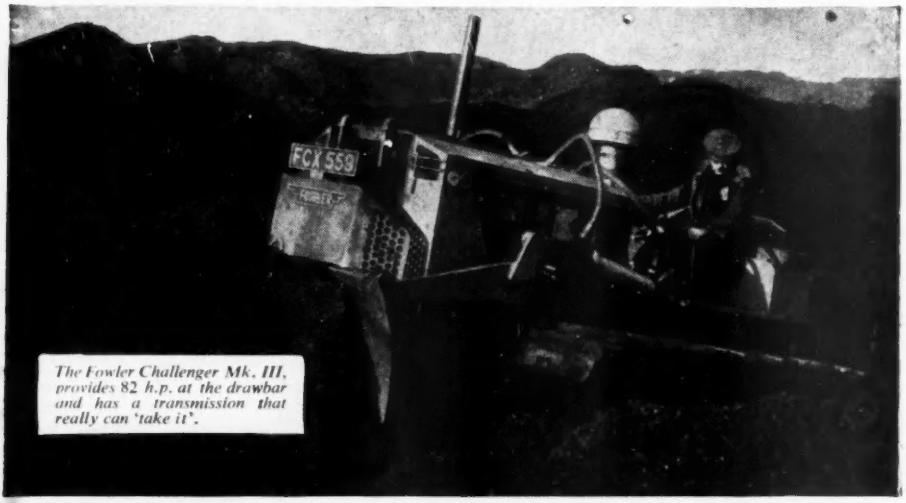

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Control spontaneous combustion

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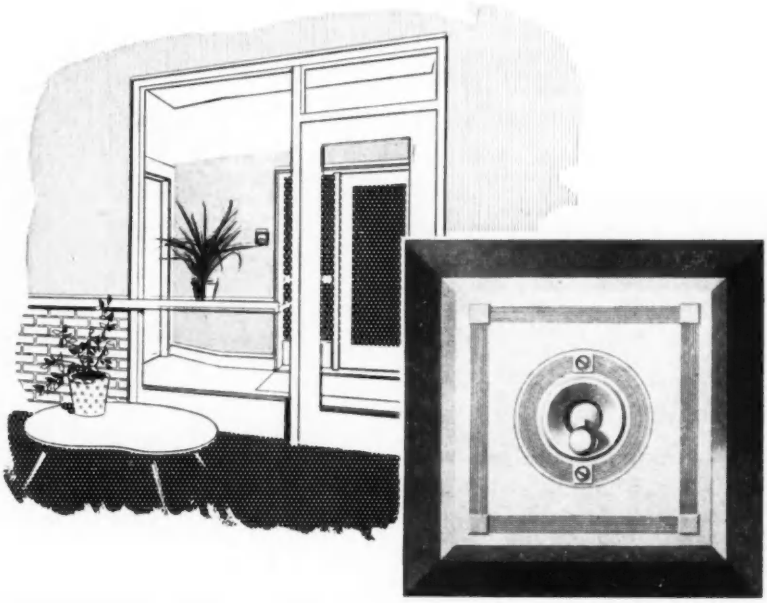

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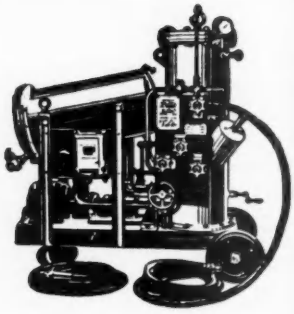

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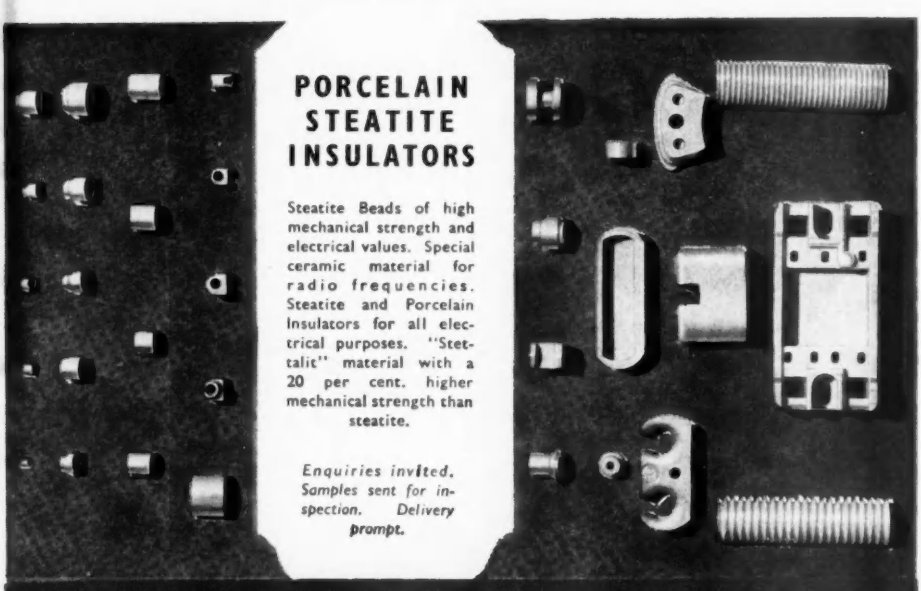

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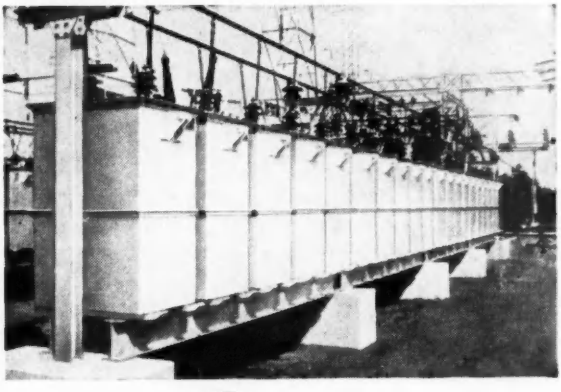
Further information is available in Publication No. 278Q.



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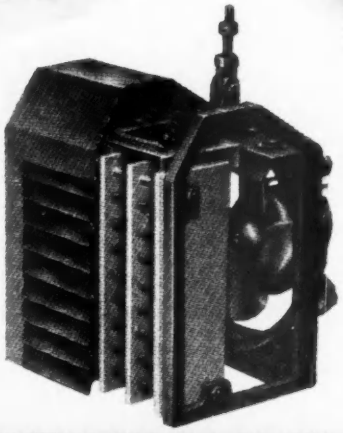

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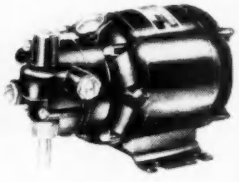

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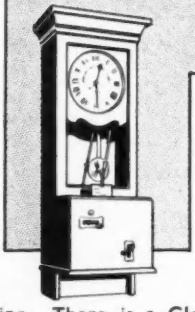

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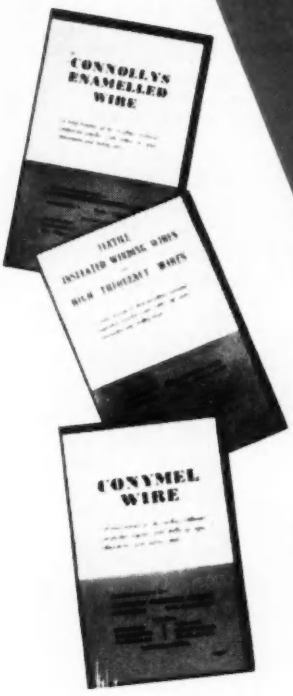

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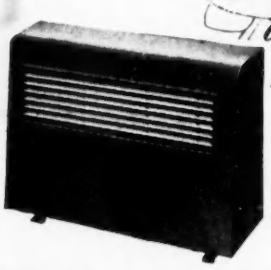

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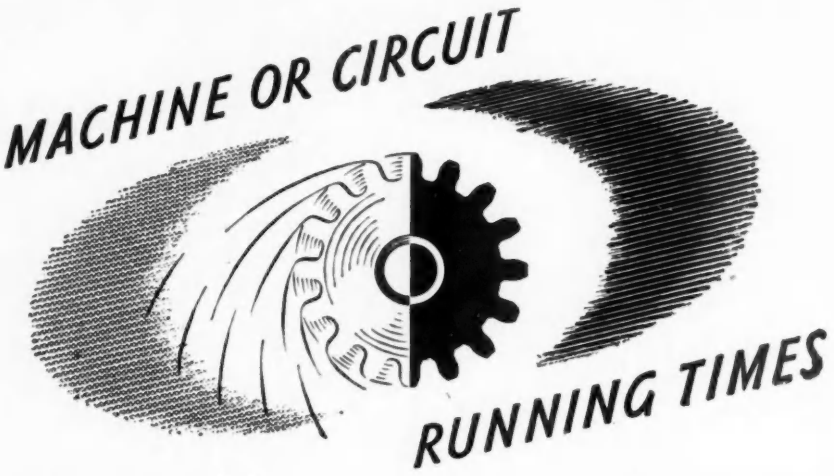

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ELECTRICAL TIMES

Vol. 120 No. 3127 THURSDAY, 11 OCTOBER, 1951

PUBLISHED EVERY THURSDAY

SIXTIETH YEAR OF PUBLICATION

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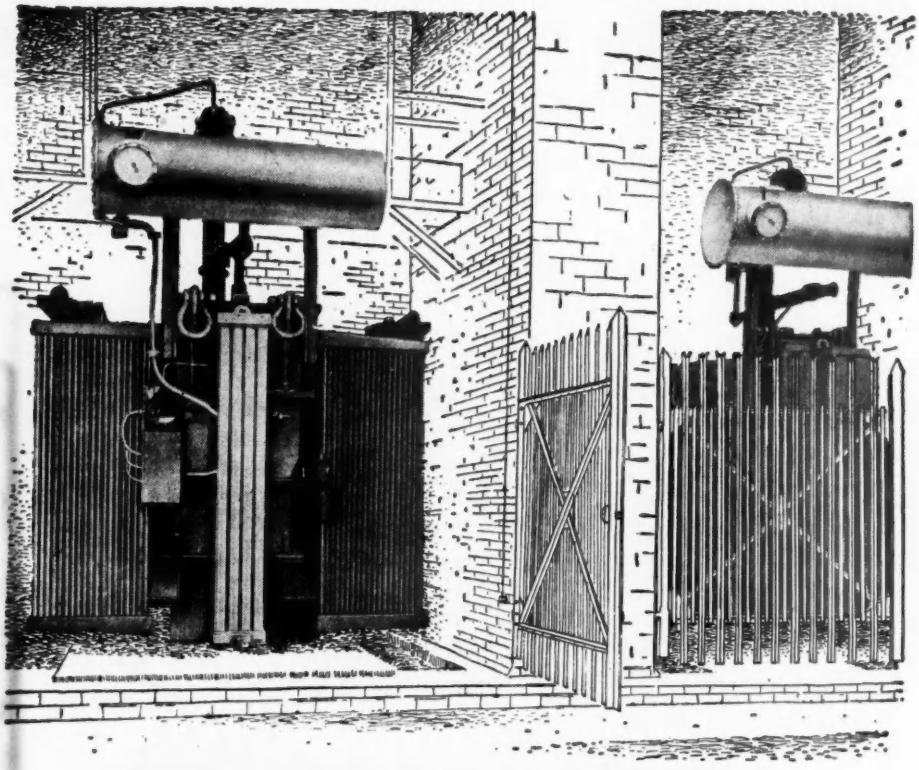

TRANSFORMERS
by G.E.C.

Two of the 5,000 kVA, 11,800/3,000 volt turbine house unit transformers at the Meaford Power Station of the B.E.A.
The whole of the electrical equipment for this Power Station was supplied by The G.E.C.

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Editorial

TELL US NOW

WHEN the Government Economic Survey for 1951 was published last April, all capital expenditure allocated was found to be lumped under one heading: no indication was given of what the electrical supply industry was to be allowed to spend. In all public discussion since then, complaints about insufficient new generating plant and cramped distribution planning have been uninformed by firm figures in terms of so many millions of pounds. Similarly, when news was released by the Southern Electricity Board, that the Treasury had allocated to the area boards permission for extra spending for the supply to new housing estates, it was impossible to obtain an official statement of the total amount involved. What was then denied to interested inquirers has now been revealed, as an incidental fact, to members of a Scottish Consumers' Consultative Council. The total of this increase, as reported elsewhere in this issue, is £2·5 million. Why was this not openly announced when it was originally agreed; why are the parent figures, to which it is an addition, still unrevealed? There is little for the Treasury to hide in this matter, except their failure to appreciate the urgency of the industry's needs. Let us have the principal figures now, and with them an assurance that capital expenditure ceilings for the B.E.A. will in future be early announced from some more central organisation than a Consultative Council. They are essential for a balanced evaluation of the policy and achievements of the nationalised industry.

TREASURY TROVE

HOW much is fuel economy worth to the country? Estimates have varied, but all the invariably high figures quoted by public speakers have proved insufficient to persuade the Treasury to countenance the charging against revenue of measures to conserve heat energy in industry, and so to reduce coal consumption. Early this year suggestions that such a charge should be permitted were met by the argument that saving in cost of fuel, in itself, was sufficient inducement to manufacturers to lag their pipes, avoid steam wastage, and improve the heat balance sheet. Naturally, this point attracted opposing contentions from those who held that effective yearly saving for the industrialists was often insufficient to make attractive the necessary investment. The matter was taken a step forward on the weekend by Mr. L. G. Northcroft in an address delivered to the Incorporated Plant Engineers. He suggested that an accepted loss on internal revenue, arising from allowing the capital cost of appropriate installations as a running expense, would be a good business risk for the economic planners. Coal saved as a result of this step would become potentially available for export, and in this state its value would be increased on three counts: it would itself improve the balance of payments situation, its availabiilty would strengthen Britain's bargaining position in international trade negotiations, and, from the wider political viewpoint, it would help buttress Western European economy. There is a snag in the delayed-action nature of such effects, but the point is worthy of serious consideration by whoever has to prepare next spring's budget proposals.

ROOM FOR RESEARCH

LABORATORIES, like landscapes, appear far more intriguing when seen from a distant viewpoint. Much of the glamour that surrounds the word research evaporates when the beholder is confronted with some seemingly over-complicated apparatus designed for carrying out an apparently simple test. Something of this feeling may affect those who this week visit the Perivale establishment of the Electrical Research Association, on the occasion of the first "open days" since the buildings themselves

were royally inaugurated in 1935. Knowledge of the number and variety of technical reports that have emanated from within those walls, and of the wide range of technical advice that has been profferred to members by the engineers and scientists conducting researches there, soon discounts this debunking attitude which actual face-to-face meeting with the tools of research is liable to induce. What is likely to be the lasting impression is surprise that so much first-rate work has been completed with so restricted facilities. No doubt the Council of the E.R.A. are taking the opportunity of demonstrating that there is no lack of ideas on what might be investigated if the promised Leatherhead laboratory were built, and it is much to be hoped that an early start for this project proves possible.

STANDARD FOR THE P.M.G.

RECOMMENDATIONS for the suppression of interference from ignition systems under the Wireless Telegraphy Act, 1949, were relatively simple to draw up, and those published have the advantage of being comparatively cheap to carry out. Corresponding rules for mains-voltage apparatus are going to present many more difficulties, not the least of which will be that of deciding what comprises "troublesome interference." This situation makes particularly timely the appearance of a revised version of British Standard 800, which bears the title "Limits of Radio Interference." It differs in many respects from its forerunner of 1939, one of the most welcome changes being an apparent simplification of measurement procedure, though full evaluation of this improvement necessarily awaits a promised new edition of the Standard covering appropriate measuring apparatus. What mention any future regulations will make of the present Standard remains to be seen; it can hardly be ignored in them, the more so because of the notably representative committee that drew it up. Indeed, the eventual solution to the problem of satisfactorily securing interference free equipment, may lie in the use of the B.S.I. certification mark mentioned in the body of the 1939 Standard, but now relegated to an appendix, pending extension of the standard tests to television frequencies. This work should be hurried on, for the certification scheme could be an acceptable answer to one aspect of a difficult problem.

THE TWILIGHT HOUR

ONCE again we approach the season of restriction on shop-window and advertisement lighting in general. The Festival is over, and we shall soon be returning to the season of unrelieved gloom in our streets until after 7 p.m. Exactly what diminution of the peak is obtained by this ban it is difficult to estimate. It is even more difficult to assess whether the saving is worth while when balanced against the loss in morale caused by this "obnubilation" (as one well-known lamp manufacturer puts it) of our city streets during the time we are returning from our daily toil. Nevertheless, the authorities are in a difficult position. If the local service centre (in common with all other shops) is ablaze with lights, it is difficult to persuade Mrs. Everyman not to use her vacuum cleaner in peak hours.

PITY THE SERVICE CENTRE

THE Service Centre, incidentally, is always in a difficult position regarding advertisement lighting and display in general—but then it seems to be its lot in life to be always in the wrong. If it tends towards restraint and conservatism, rude comments are made about Civil Service methods and the dead hand of officialdom; if it is go-ahead and enterprising, it is taking the bread out of the mouth of the private trader. If its windows are discreetly dark, it is a poor advertisement for its own commodities—if it is brightly and cheerfully lit, its consumption is blamed for the cuts at breakfast time the next day. If its windows are discreetly unimaginative it is dead from the neck upwards—if it goes in for clever display it is wasting public money. It is, of course, an extravagance for it to be there at all—but if it isn't there, the Board is accused of neglecting consumer service. Taken all in all, service centres must feel that they are indeed nobody's darling.

Meteor

Composite Core Current Transformers

A METHOD FOR THE ESTIMATION OF ERRORS

by A. A. HALACSY, D.Sc.(Eng)., A.M.I.E.E., M.A.I.E.E.

HIGH-CLASS CTs are made often with composite iron cores in order to keep the errors within the narrow limits set by the standard specification. A method of calculation of the errors in such CTs is demonstrated as follows. It should be kept in mind that the phase-angle error of a CT is due chiefly to the pure magnetising current, whereas the ratio error depends on the watt-loss of the iron core.

Phase-angle Error

To keep the phase-angle error within narrow limits it should not depend much on the load. This would be so if the magnetising current on which it depends varied in direct ratio with a resistive load, that is, if the magnetising curve were a straight line. Not a single one ferro-magnetic material has such a straight magnetising curve. However, it can be

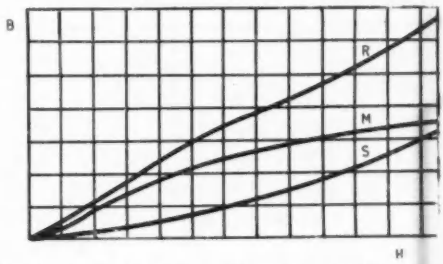


Fig. 1. Magnetising curve for a curve composed of 11·8% Mumetal, 88·2% Stalloy.
M = Mumetal S = Stalloy R = resultant magnetisation curve

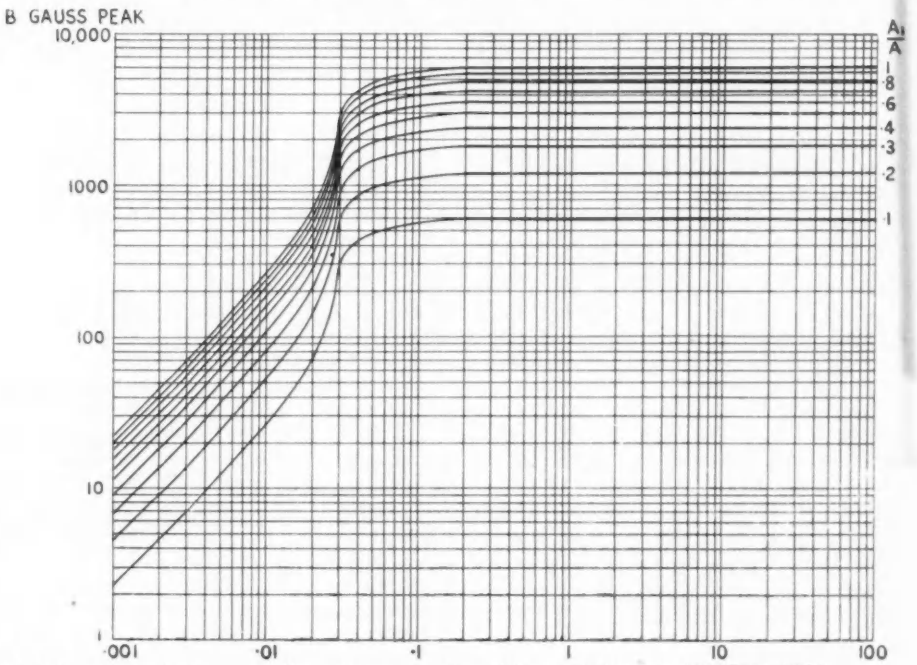


Fig. 2(a). Magnetisation curves for various proportions of Mumetal (A_1)

approached fairly well by building up the iron core of more than one material. The idea is to fill the sag in the magnetising curve of a less magnetised component with the buckle of the magnetising curve of a more saturated component.

In a composite-core CT both components of the core are linked with the same number of turns. In other words, the magnetising force H is the same in both components of the core. However the magnetic induction B differs in them and its value can be read against H from the relevant magnetising curves of the materials.

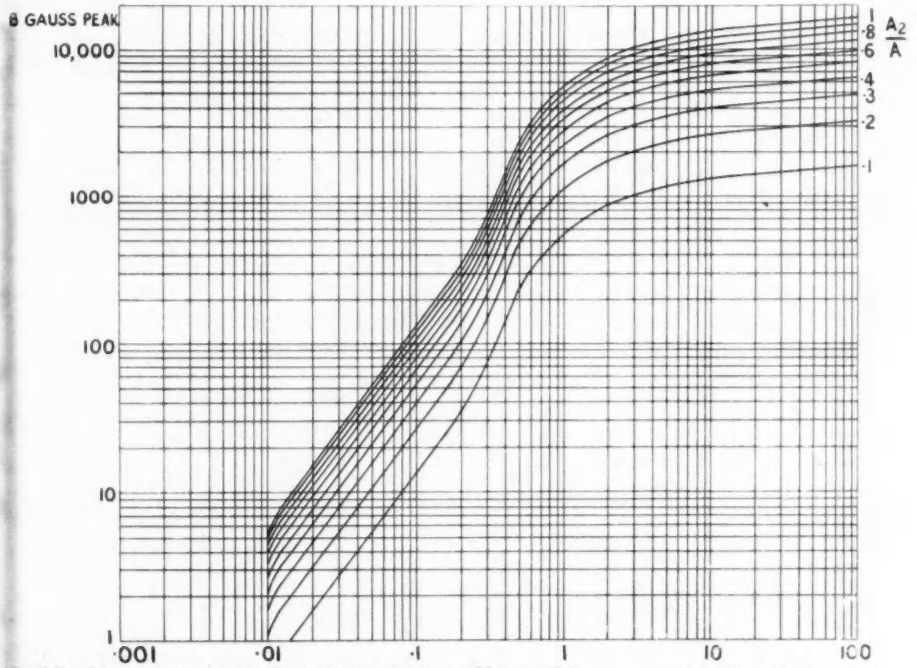


Fig.2(b). Magnetisation curves for various proportions of Stalloy (A_2)

Say the magnetic induction is B_1 in the material No. 1, occupying a cross-sectional area A_1, and B_2 in the material No. 2, occupying a cross-sectional area A_2. In this case the total magnetic flux in the complete core is

$$\Phi = A_1 B_1 + A_2 B_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Denoting the whole cross-sectional area of the core by $A = A_1 + A_2$ and imagining a "resulting magnetic induction" B for the whole cross-section there follows:

$$\Phi = AB \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The imagined "resulting magnetic induction" B due to the mag. force H is the result of the combination of equations (1) and (2).

$$B = \frac{A_1}{A} B_1 + \frac{A_2}{A} B_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

A series of those resulting Bs against the corresponding Hs gives the resulting magnetisation curve of the core composed of the materials No. 1 and No. 2 in a cross-sectional ratio A_1/A_2.

Plotting

A two-way logarithmic graph sheet is best for such representation and calculation, because on such a sheet the various ratio-curves of the same composing material No 1. and No. 2 respectively are derived from the basic one by shifting it towards the lower values of B and with a distance equal to the log. of the ratio A_1/A, and A_2/A; as shown in Fig. 2 (a) and (b), where the material No. 1 is Mumetal and No. 2 is Stalloy.

The graphical calculation must be done in a scale large enough to minimise errors and give a result accurate enough for practical purposes. Magnetising curves issued by different firms should be handled with care, because some are

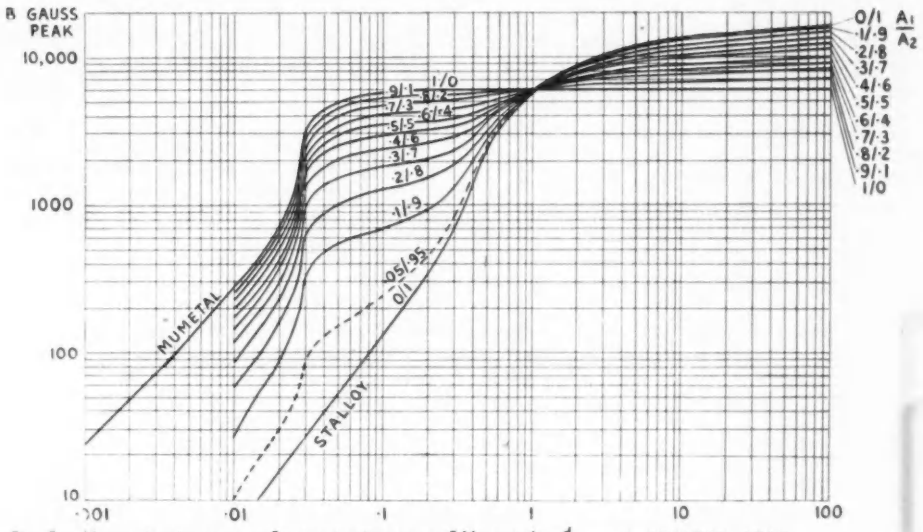


Fig. 3. Magnetisation curves for composite cores of Mumetal and Stalloy in varying proportions of cross sectional areas A_1 to A_2

scaled in r.m.s. and others in peak, that is, $\sqrt{2}$ r.m.s. values.

Magnetising Current

The mag. current at a given load of the CT can be calculated from the resulting magnetising curve of the composite core in the well-known ways. The sum of the external and internal burden (both supposed to be non-varying impedances) divided by the amps passing through gives the e.m.f. required in the CT. B is calculated from that e.m.f. by the well-known transformer equation. The related H can be read against B from the resulting

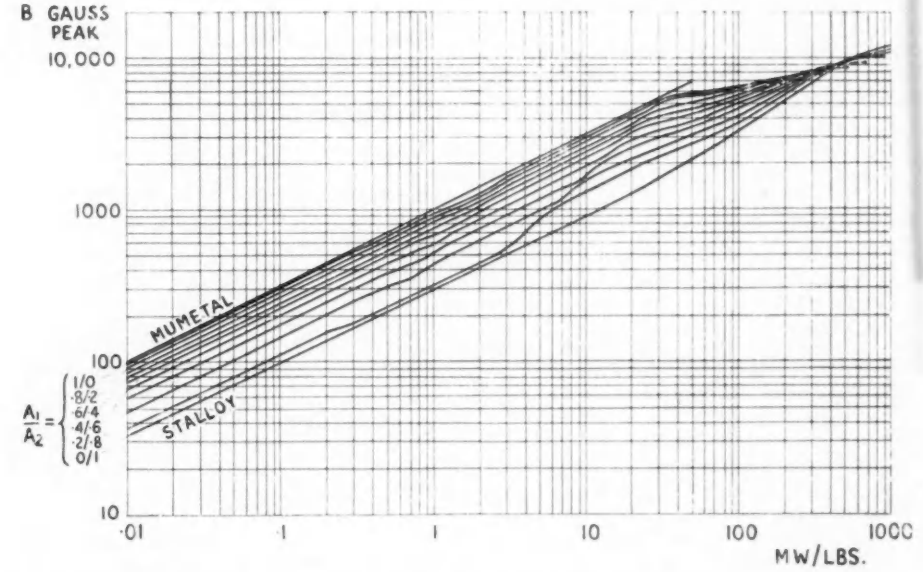


Fig. 4. Watt loss curves of cores composed of Mumetal and Stalloy, based on values of flux density

magnetisation curve and expressed in amp turns per unit length. Those amp turns per unit length multiplied by the mean length of the path of the magnetic flux and divided by the turn number gives the mag. current making up the phase-angle error.

Ratio Error

The ratio error of a CT depends mainly on the watt-loss in the iron core, anyhow after adjusting the turn number of the secondary. Typical curves of the w watts per lb based on B are issued by the firms producing magnetic materials.

The total weight of a core composed of W_1 lb of material No. 1 and of W_2 lb of material No. 2 is in lb:

$$W = W_1 + W_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The total watt loss is:

$$w\,W = w_1\,W_1 + w_2\,W_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

w, w_1 and w_2 denoting the related watts per lb.

Dividing equation (5) by W:

$$w = w_1\frac{W_1}{W} + w_2\frac{W_2}{W} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The further procedure is quite similar to the one described above and following equation (3) (i.e. the one having resulting B) *if* the design were to be based on the weights of the materials composing the iron core.

However, the design is based on cross-sectional areas rather than on weights. Weight = (density) × (cross-sectional area) × (mean length of the core). The mean length l of the core is the same for both of the components, one of which has a density γ_1 and the other one γ_2.

$$W_1 = A_1 l \gamma_1$$
$$W_2 = A_2 l \gamma_2$$
$$W = A_1 l \gamma_1 + A_2 l \gamma_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Watt Loss

The combination of equations (7) and (6) results the watt loss per lb of the whole composite core.

$$w = w_1\frac{A_1\gamma_1}{A_1\gamma_1 + A_2\gamma_2} + w_2\frac{A_2\gamma_2}{A_1\gamma_1 + A_2\gamma_2} \quad \ldots\ldots (8)$$

Table I shows the values of the multipliers of w_1 and w_2 based on $\gamma_1 = 8{\cdot}8$ g/cc for Mumetal and $\gamma_2 = 7{\cdot}55$ g/cc for Stalloy.

There is one snag in equation (8). The set of w, w_1 and w_2 in that equation must relate to the same H, this and not B being common in both components of the iron core, as explained above.

However, the watt losses are usually given and requested against B, with a necessity either to convert the watt-loss curves resulting by equation (8) to an H base or to proceed as follows.

Read H against a value of B from the resulting mag. curve of the composite core (Fig. 2). Read B_1 and B_2 against that H from the *original* mag. curve of each material composing the core. Read w_1 and w_2 related to those B_1 and B_2 from the *original* watt loss

TABLE I—MULTIPLIERS FOR GIVEN CORE CONSTRUCTION

Area of Mumetal	Area of Stalloy	Multipliers of w_1	Multipliers of w_2
$\gamma_1 = 8{\cdot}8$ A_1	$\gamma_2 = 7{\cdot}55$ A_2	$\frac{A_1\gamma_1}{A_1\gamma_1 + A_2\gamma_2}$	$\frac{A_2\gamma_2}{A_1\gamma_1 + A_2\gamma_2}$
0	1	0	1
0·05	0·95	0·058	0·942
0·075	0·925	0·086	0·914
0·1	0·9	0·114	0·886
0·118	0·882	0·133	0·867
0·143	0·857	0·163	0·847
0·15	0·85	0·17	0·83
0·2	0·8	0·226	0·774
0·25	0·75	0·28	0·72
0·3	0·7	0·333	0·667
0·4	0·6	0·436	0·564
0·5	0·5	0·538	0·462
0·6	0·4	0·635	0·365
0·7	0·3	0·732	0·268
0·8	0·2	0·823	0·177
0·9	0·1	0·913	0·087
1	0	1	0

curves of those materials. Calculate w from equation (8). Those calculated values of w against the respective B plot the curve of the "resulting watt loss" against the "resulting" B of the composite core (Fig. 4).

Closing Remarks

The curves render a good visual representation of the contribution of the two composing materials to the magnetic induction and to the total watt losses at various loads.

They help to avoid some mistakes as well, e.g. designers of CTs are used to considering w as approximating to a parabolic function of B. This supposition does not hold and may lead to major errors in the case of a composite core.

The curves resulting from the above discussion, i.e. the "resulting B" against H and the "resulting watt loss" against "the resulting B" can be used for the calculation of the errors of a composite core CT just as the ordinary mag. curve and watt-loss curve of a CT-core made of a single kind of material. The figures presented show typical curves for Mumetal and Stalloy.

Holme Moss

World's most Powerful Television Station goes into Operation in the Pennine Chain

ABOUT nine miles to the south-west of Huddersfield, fronting the Woodhead Road, is Holme Moss, the site of the B.B.C.'s latest television station. This remote and lonely site, in the heart of the Pennines, has an elevation of over 1,700 ft above sea level—an ideal site for television broadcasts.

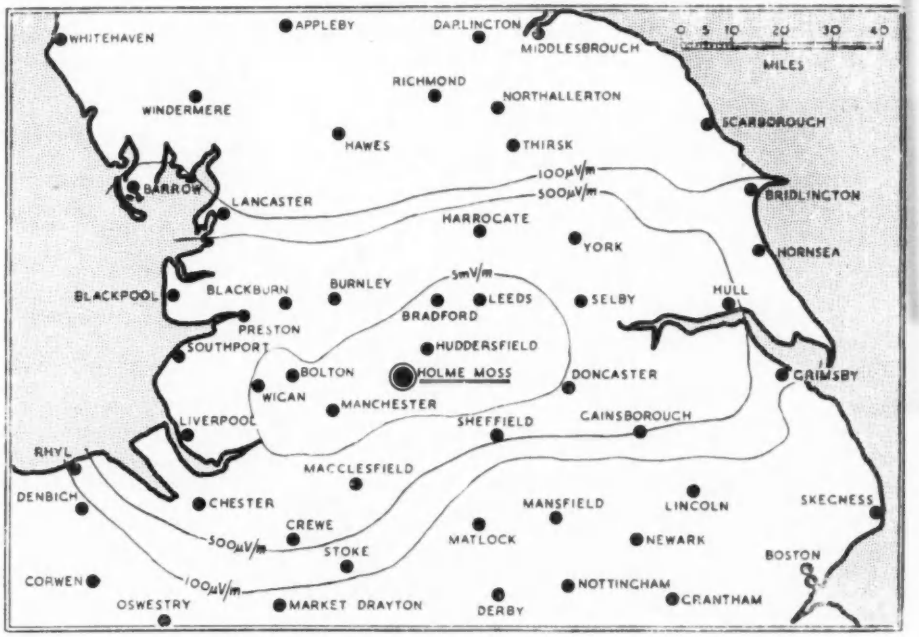
This station, however, is the second high-power station to be constructed under the B.B.C.'s post-war programme, the first, of course, being Sutton Coldfield. Two further stations are contemplated, and when they are completed, television should be within reach of more than 78% of the population. The station is to go into regular service tomorrow, although full power experimental transmissions have been taking place for some time.

Site Details

The site covers an area of 150 acres, and on it has been constructed a building for the transmitters, an annexe for a substation and garage, and a 750 ft mast to carry the transmitting aerial.

In plan, the main building is somewhat similar to that at the Sutton Coldfield station, being "L" shaped. One wing is given over to the transmitters and their associated equipment, and the other to offices, a viewing room, and amenities for the staff.

Two transmitters are installed in the main building—one for vision and one for sound. Both these have been built by Marconi's Wireless Telegraph Co., Ltd. The vision transmitter has an output of about 35 kW while the sound transmitter has a power output of about 12 kW. The transmitting aerial, about 750 ft high, has an all-up weight of over



A general view of the station. The 758 ft. mast supporting the combined vision and sound transmitting aerial and the standby mast and aerial

100 tons. Designed by the B.B.C., the mast was erected by B.I. Callender's Construction Co.

As can be seen from the map, the service area covers a large section of the industrial Midlands, and will thus bring t.v. into some of the most densely populated areas in the country. Experiments to date, however, have shown that the areas indicated on the map have been somewhat conservatively estimated, and reports of good reception have been received from as far off as Northern Ireland.

Power Supplies

The main power supplies are brought in by cable at 11 kV over duplicate feeders to the transmitting station substation. The main switchgear is of the metal-clad type, and manufactured by Reyrolles. At the substation the voltage is stepped down to 415 and distributed to two low-voltage switchrooms, one in an annexe to the transmitters, and another in the main building which supplies all auxiliary services. The incoming transformer is rated at 500 kVA, and a spare unit is held on site in case of emergency. Control circuits for the transmitters are operated at 50 volts, the supply being derived from metal rectifiers, while a 240 V battery is available for the emergency lighting system.

The power conversion plant for the vision transmitter is contained in an enclosure 35 ft long which is located behind the transmitter. High-voltage supplies are obtained from hot-cathode mercury-vapour rectifiers. In order to ensure constancy of voltage from these units, the incoming 415 a.c. supply is stabilised and the phases balanced by three separate moving-coil voltage regulators. In addition, the high voltage d.c. output circuits are provided with shunt valve stabilisers which result in the supplies having very low output impedances.

A special circuit has been used for the modulator which requires a single supply of 6 amps at 3·5 kV, with both positive and negative lines insulated from earth. As the varying r.f. stage grid current returns through this supply, and because the modulator anode current varies with the signal level, the source impedance must be kept low. A stabiliser has therefore been provided to give a source impedance of 0·5 ohm, and an additional stabiliser results in an impedance of one-sixth of an ohm between the negative supply terminal and earth.

The filaments of the valves in the last three r.f. stages of the vision transmitter are supplied with d.c. from a motor generator set. This unit is associated with an electronic regulator which keeps the voltage constant to within 0·1% and limits filament current to 110% of normal when starting from cold. The remaining valves in the transmitter are a.c. heated.

For the sound transmitter, a similar power enclosure is used, although its size is not so great as that of the vision annexe. Anode and bias supplies are provided by rectifier units, and again a small electronically controlled motor-generator set is used for providing the d.c. for the filament heating in the modulated output stage. The remainder of the valves are a.c. heated. All the valves in this transmitter are air cooled.

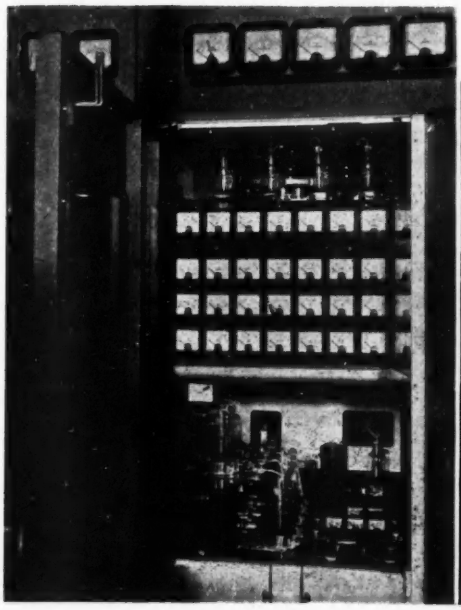
The Vision Transmitter

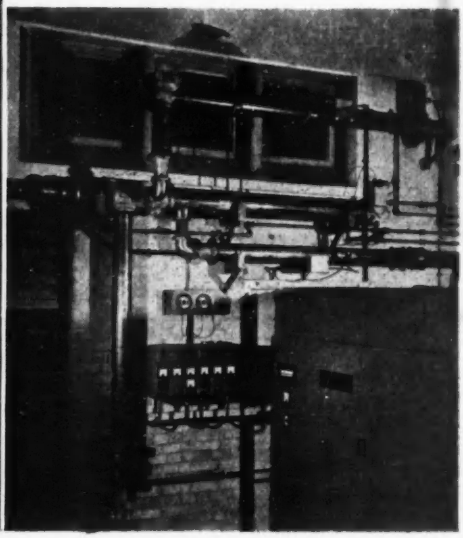
The vision transmitter is the most powerful in service anywhere in the world, having a peak white power of 45 kW. It is arranged in eight cubicles placed side by side. Viewed from the front the r.f. stages are in increasing order of power from left to right, and the modulator stages run from right to left. Thus the r.f. output stage falls next to the final modulator stage near the centre of the assembly.

Taking the r.f. side of the transmitter, the first unit is the drive unit which consists of a quartz-crystal oscillator, working at one-sixth of the carrier frequency, followed by two stages of multiplication and an amplifier. This feeds into the low-power stages which consist of a push-pull amplifier using two TT 12 beam tetrode valves, followed by a push-pull amplifier using four TT 16 tetrodes. Next is the third r.f. amplifier consisting of two BR 125 air-blast cooled triodes in a balanced bridge push-pull circuit, and the output from these is fed into a cathode follower stage also using BR 125's. Finally is the modulated output stage which comprises two BW 165 water-cooled thoriated filament triodes.

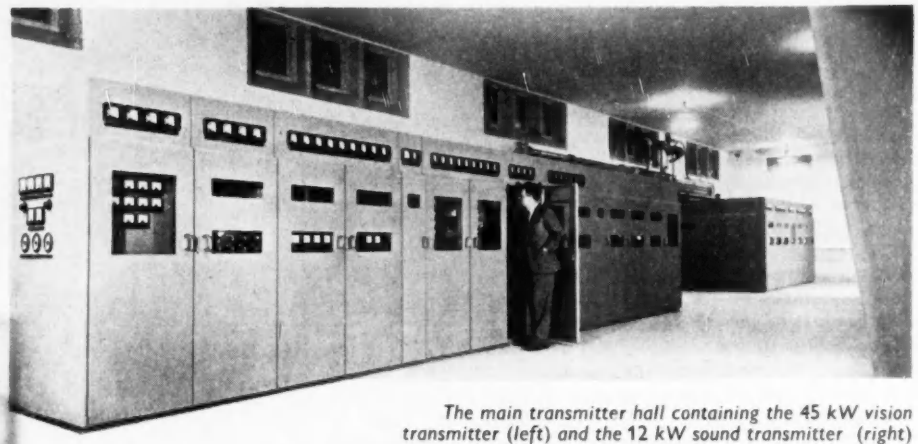
The modulator begins with the pre-amplifier which is designed to accept a vision signal having an overall amplitude of 0·7 V and a picture : synchronising signal ratio of 70 : 30 in terms of amplitude. This signal is amplified to 20 volts and various corrections applied.

(Above) The control desk for the medium power standby transmitter, part of which can be seen immediately in front of the desk. These transmitters have an output power of 5kW (vision) and 2 kW (sound)





(Left) The final stage of the modulator in the main vision transmitter, and (right) the combining circuit for the high power vision and sound transmitters



The main transmitter hall containing the 45 kW vision transmitter (left) and the 12 kW sound transmitter (right)

Output is taken from this to the sub-modulator which consists of a shunt regulated amplifier followed by a cathode-follower stage. This raises the signal level to 150 volts and has an output impedance of about 30 ohms.

The black level clamp follows, which is a unit which controls the black level radiated by the transmitter and prevents variation in picture black levels. Last is the modulator unit, which is fed with an overall signal amplitude of 140 V from the clamp unit and delivers a 1,200 V modulating signal to the grids of the modulated r.f. amplifier.

The sound transmitter is fairly normal and has a carrier power of 12 kW and employs high-power Class B modulation with the usual negative feedback circuits.

Valve Cooling

Each transmitter has its own valve cooling plant contained in a separate room. This arrangement has been adopted in order to isolate the noise of the cooling plant from the rest of the transmitter area. Air from each blower can be circulated round a closed system until the temperature is raised to a suitable value, and then surplus warm air may be used to heat the building or may be exhausted to atmosphere.

The BW 165 valves which are water-cooled, use distilled water pressurised with 5 lb/sq in. of nitrogen to exclude air. This flows in a closed circuit and the heat is again taken away to warm the building.

Output Circuits

The vision transmitter supplies a double sideband signal to its output feeder. This has to be reduced to vestigial sideband form for transmission. A filter is therefore connected between the transmitter output and the combining unit. This filter comprises a high-pass and low-pass section and is mounted on the wall behind the transmitter. The low-pass section is terminated by the 5·15 ohm-feeder leading to the aerial, and the high-pass section by a water-cooled constant resistance absorber load which dissipates about 1 kW when normal pictures are being transmitted.

In order to avoid the use of a diplexer at the top of the aerial, both sound and vision signals are combined and transmitted to the top of the mast by a single 5 in. coaxial feeder. A special combining unit has therefore been developed to prevent cross modulation.

The actual aerial array consists of eight vertical folded dipoles arranged in two identical groups placed one above the other and separated by a distance of approximately one wavelength. Each dipole incorporates a 7·5 kW heater to prevent ice formation. These were made by Geo. Bray Ltd.

Emergency Services

Under normal conditions the vision signal from London travels over coaxial cable via Manchester. Should a fault develop on this line, however, the signal from Sutton Coldfield may be picked up by an aerial mounted at the 600 ft level on the main mast and this signal can be rebroadcast. The pictures received have so far been free from fading and of good quality but occasionally suffer from slight car interference.

In the event of the main transmitters failing, low power sound and vision units are installed as stand-by, the sound having an output of 2 kW and the vision of 5 kW. These will keep the local area served.

Transport and Telephony

Chairmen's Addresses to Two I.E.E. Local Centres

APPROPRIATELY enough for a meeting at Liverpool, MR. E. W. ASHBY, B.SC., chose as the subject of his chairman's address to the I.E.E. Merseyside and North Wales Centre, "Electricity in the Marine Service." He began with a review of main machinery for ships, pointing out that the keynote is reliability, with availability of fuel and ratio of time at sea to time in port as other important factors.

Broadly, the choice today is between steam turbine geared and turbo-electric, and diesel with direct or geared drive or with electric drive. Recent steam practice is to utilise higher pressures of the order of 500 lb/sq in. at 600°/700° F or above, and systems of steam reheat are in use. Efficiency has stayed about the same for many years. Diesel oil costs some 50% more than boiler fuel oil, but extensive research suggests that it may be possible with suitable preliminary processing to use heavy residual fuel oil in diesels.

Electric Propulsion

Electric propulsion is more expensive, heavier, and slightly less economical than direct drive. Principal advantages are inherent smoothness of drive, and reduced risk of vibration. As regards medium-sized cargo vessels, the attraction of diesel electric drive has been claimed to lie in the use of a number of small, higher speed engines of standardised design, spread throughout the ship and driving a.c. generators, for ease of parallel operation. A few ships have been built with three, four or six main diesel alternators, and a saving of up to 20% of the weight of a direct driving engine has been realised. Paralleling may be simplified, but with units of over 1,000 h.p. each supplying a single propulsion unit excessive engine wear may occur, due to the relative incidence of engine impulses.

After describing some recent installations in comparatively small craft, Mr. Ashby went on to consider auxiliary gear, with special reference to tankers. For these, steam turbine-driven auxiliary generators may be used, and all cables are metal sheathed and so installed as to avoid tension and chafing due to the working of the ship, expansion bends and glands being provided at specified points. For ships in general, there is an increasing interest in alternating current for auxiliaries, much of the attraction being the simplicity of the squirrel cage induction motor when compared with d.c. commutators and brush-gear. Higher machine r.p.m. and three-phase distribution are other possibilities making a.c. popular. Major obstacle lies in the cargo winches and pumps and fans, which need speed regulation.

In the final section of his paper, Mr. Ashby reviewed the light current aids to navigation, including d.f. and radar, and finally he discussed dock installations, and the ways in which electricity can contribute towards a quick turn round of shipping.

Telephoning

At Birmingham, MR. W. H. BRENT, B.SC., M.I.E.E., addressed the South Midland Centre on "The Progress of Telecommunications in the Midlands." He began with a review of the post-office regional organisation, with special reference to the Birmingham area, and then went on to describe the telegraph service there. In 1937 a decision had been made to convert the Birmingham zone to a scheme for automatic routing to required teleprinter offices, but the outbreak of war caused a hold-up, and a manually operated scheme was introduced. In October, 1950, an automatic switching centre was at last set up, one of the first in the country. Saving of time with the new system will cut by half the number of teleprinters necessary at the Birmingham central post office.

Telephones were first installed in Birmingham in 1879. In 1931 the first automatic exchanges were introduced. Plans are now well in hand for the mechanisation of the trunk services, so that no call will require more than one operator. Such a service necessitates sufficient circuits between zone centres to ensure better than one ineffective call in 50 at the busiest time. It is planned that a suitable exchange will be brought into service in Birmingham about 1955.

Turning to transmission, Mr. Brent said that the total energy loss permitted between subscribers on the largest trunk lines, using standard instruments, was 30 db, i.e. 1/1,000 part of the power transmitted had to be received. After allowing for other losses, total loss in lines and junctions is limited to 15 db.

Short-circuit Currents

J. L. BOGGIS, A.M.I.E.E., GRAD.I.MECH.E.

discusses whether resistance can be neglected when calculating network fault conditions

THE percentage reactance method, resistance being neglected, of calculating short-circuit currents has been widely published, and has received official recognition in Appendix 'K' to B.S. 116:1937, Part 1, where a warning is given that for long lines and cables resistance may be significant. If it may not be neglected, then the calculation of the symmetrical short-circuit currents for a simple network is tiresome, and for a complex network is laborious. But, as will be shown, the labour of calculation can be eased.

As an alternative to the percentage method, in which the impedances of the generators, transformers, cables, etc., are expressed as percentages on the same kVA base, the ohmic method will be used here. In this method all impedances are expressed in ohms. The advantage will lie with the method which requires the least conversion of the given data to the alternative form.

It is well known that for low-voltage networks resistance may not be neglected without serious error; can resistance be neglected for high-voltage networks?

Effect of Cable Resistance

In Fig. 1 is shown a 11 kV or 6·6 kV 0·2 sq in. 3-core cable supplied from a generating station where the fault level is 250 MVA. At 1,000 yds from the station the fault level, including the effect of cable resistance, will be:—

$$Z_{\text{generator}} = \frac{kV^2}{MVA} = \frac{11^2}{250} = j0{\cdot}484 \text{ ohms}:$$

assumed entirely reactive.

TABLE 1: Errors caused by neglect of resistance.

Cable length yds.	0	500	1000	2000	4000	8000
11 kV—% error ...	0·0	0·7	2·6	7·8	19·5	37·6
6·6 kV—% error ...	0·0	4·4	12·4	27·4	47·5	66·2
11 kV phase angle ...	90°	83°	77°	68°	57°	47°
6·6 kV phase angle ...	90°	73°	63°	52°	43°	37°
Generator impedance	0·484 /90° for 11 kV.					
,, ,,	0·174 /90° for 6·6 kV.					
Cable impedance ...	0·147 /30° ohms per 1000 yds.					

$Z_{\text{cable}} = 0{\cdot}127 + j\,0{\cdot}074$ ohms, for a standard 3-core belted cable.

Total $Z = 0{\cdot}127 + j\,0{\cdot}558 = 0{\cdot}572 \angle 77{\cdot}2°$ ohms.

$$\text{Fault level} = \frac{kV^2}{Z} = \frac{11^2}{0{\cdot}572} = 211 \text{ MVA}.$$

For this case the fault level neglecting resistance is 217 MVA, which is in error by only 2·6%.

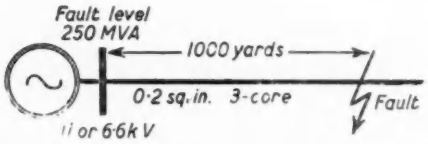


Fig. 1. Symmetrical short-circuit conditions which are discussed in this article

By similar calculations the values given in Table 1 were obtained for 6·6 kV and 11 kV, 3-phase, underground cable systems. For cable lengths of more than 1,000 yds the results are so much on the safe side as to be misleading. Note the change of phase angle towards 30°—the cable phase angle—as the cable lengthens.

If the R/X ratio is generally less than one-third the error will not exceed 5·4%, or for other R/X ratios see Table 2.

TABLE 2: Errors at various R/X ratios.

R/X ...	0·1	0·2	0·3	0·4	0·5	0·6	0·7
Error %	0·5	2·0	4·4	7·7	11·8	16·6	22·1

Network Reduction

Where resistance cannot be neglected, what can be done to ease the labour of computation? Firstly, the a.c. network analyser, which is often quoted as the solution of this problem, is not available for trivial calculations; but for complex net-works it *may* be the only practical solution.

D.C. network analysers are more readily available than a.c. ones, but they require some artifice before they can handle vector calculations: such as assuming that the phase angle throughout the network is roughly constant.

Confining our attention to simple networks, which can be analysed without analogue com-

puters, the network reductions required will be: (a) series impedance to a single equivalent; (b) parallel impedances to a single equivalent; (c) star-delta and delta-star conversions; (d) other network theorems, e.g. multi-point star conversion.

Series and Parallel Impedances

As the series connection requires the addition of impedances, they are most conveniently written in the rectangular form, i.e. R+jX.

For the parallel connection of two impedances there is either $\frac{Z_1.Z_2}{Z_1+Z_2}$ or $1/Z=1/Z_1+1/Z_2$ .. (1) and (2). By the first formula, impedances of 4+j3 and 5+j2 in parallel are reduced to their equivalent as follows:—

$$Z=\frac{(4+j3)(5+j2)}{9+j5}=\frac{(20-6)+j(15+8)}{9+j5}$$

$$=\frac{(14+j23)(9-j5)}{(9+j5)(9-j5)}=\frac{241+j137}{81+25}=2{\cdot}27+j1{\cdot}29$$

$=2{\cdot}61\ \underline{/29{\cdot}7^\circ}$ ohms. From (1).

Or by the second formula:—

$$Y_1=1/Z_1=\frac{4-j3}{16+9}=0{\cdot}160-j0{\cdot}120 \text{ mhos.}$$

$$Y_2=1/Z_2=\frac{5-j2}{25+4}=0{\cdot}173-j0{\cdot}069 \text{ mhos.}$$

$$0{\cdot}333-j0{\cdot}189 \text{ mhos.}$$

$$Z=\frac{0{\cdot}333+j0{\cdot}189}{0{\cdot}333^2+0{\cdot}189^2}=2{\cdot}27+j1{\cdot}29 \text{ ohms as before.}$$

The reciprocal method is superior because each stage in the calculation is a repetition of the simple operation:

$$\frac{\text{Conjugate}}{\text{Modulus squared}}=\frac{R-jX}{R^2+X^2}.$$

Furthermore, tables of the reciprocals of complex numbers[1] have been published which make the operation of finding 1/Z very simple. With the aid of these tables series-parallel circuits are quickly reduced to equivalents.

Star-Delta Conversion

The star-delta and delta-star conversions are frequently required for the reduction of networks; but, unfortunately, they do not lend themselves to easy methods of calculation. These conversions, which apply to impedances between three terminals, can be extended to apply to impedances between four or more terminals[2]; but generally the three terminal forms are sufficient for simple power networks.

In Fig. 2 three delta impedances Z_{ab}, Z_{bc}, and Z_{ac} are connected between terminals a, b and c; the equivalent star impedances are Z_a, Z_b, and Z_c, then for star to delta:—

$$Z_{ab}=Z_a+Z_b+\frac{Z_a.Z_b}{Z_c}=Z_{bc}.\frac{Z_a}{Z_c}=Z_{ac}.\frac{Z_b}{Z_c} \quad \ldots (3)$$

$$Z_{bc}=Z_b+Z_c+\frac{Z_b.Z_c}{Z_a}=Z_{ab}.\frac{Z_c}{Z_a}=Z_{ac}.\frac{Z_b}{Z_a} \quad \ldots (4)$$

$$Z_{ac}=Z_a+Z_c+\frac{Z_a.Z_c}{Z_b}=Z_{ab}.\frac{Z_c}{Z_b}=Z_{bc}.\frac{Z_a}{Z_b} \quad \ldots (5)$$

A useful mnemonic is the cancellation of the subscripts, like this: $Z_{ac}=Z_{bc}.\frac{Z_a}{Z_b}$; $_{bc}.\frac{a}{b}=_{ac}$.

For delta to star:—

Let $Z=Z_{ab}+Z_{bc}+Z_{ac}$.

$$Z_a=\frac{Z_{ab}.Z_{ac}}{Z}=Z_b.\frac{Z_{ac}}{Z_{bc}}=Z_c.\frac{Z_{ab}}{Z_{bc}} \quad \ldots \quad \ldots (6)$$

$$Z_b=\frac{Z_{bc}.Z_{ab}}{Z}=Z_a.\frac{Z_{bc}}{Z_{ac}}=Z_c.\frac{Z_{ab}}{Z_{ac}} \quad \ldots \quad \ldots (7)$$

$$Z_c=\frac{Z_{ac}.Z_{bc}}{Z}=Z_a.\frac{Z_{bc}}{Z_{ab}}=Z_b.\frac{Z_{ac}}{Z_{ab}} \quad \ldots \quad \ldots (8)$$

The cancellation of the subscripts is still possible, e.g.

$$Z_a=Z_c.\frac{Z_{ab}}{Z_{bc}};_a=_c.\frac{ab}{bc}.$$

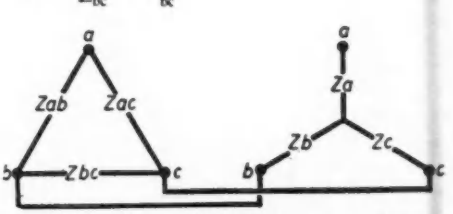


Fig. 2. Diagram for delta-star conversion

An example of the delta-star conversion follows in which polar-form complex numbers have been used for the multiplications and divisions; reference [3] in the bibliography eases the work of changing the impedances to polar form. The example shows a short cut that can be taken when two of the arms of the delta or star have the same phase angle, e.g. same cable type and section. Referring to Fig. 3:—

$Z_{ab}=0{\cdot}338+j0{\cdot}153=0{\cdot}370\ /24{\cdot}3^\circ$ ohms.

$Z_{bc}=0{\cdot}169+j0{\cdot}0765=0{\cdot}185\ /24{\cdot}3^\circ$ ohms.

$Z_{ac}=0{\cdot}101+j0{\cdot}0723=0{\cdot}124\ /35{\cdot}6^\circ$ ohms.

$\text{Sum}=0{\cdot}608+j0{\cdot}302=0{\cdot}679\ /26{\cdot}4^\circ$ ohms.

$$Z_a=\frac{Z_{ab}.Z_{ac}}{\text{Sum}}=\frac{0{\cdot}370\ /24{\cdot}3^\circ.0{\cdot}124\ /35.6^\circ}{0{\cdot}679\ /26{\cdot}4^\circ}$$

$=0{\cdot}0676\ /33{\cdot}5^\circ=0{\cdot}0564+j0{\cdot}0372$ ohms.

$$Z_c=\frac{Z_{bc}.Z_a}{Z_{ab}}=\tfrac{1}{2}.Z_a=0{\cdot}0282+j0{\cdot}0186 \text{ ohms.}$$

$$Z_b=\frac{Z_{bc}.Z_{ab}}{\text{Sum}}=\frac{0{\cdot}185\ /24{\cdot}3^\circ.0{\cdot}370\ /24{\cdot}3^\circ}{0{\cdot}679\ /26{\cdot}4^\circ}$$

$=0{\cdot}101\ \underline{/22{\cdot}2^\circ}=0{\cdot}0935\times j0{\cdot}0382$ ohms.

A tabular method, using rectangular-form complex numbers, will be found in reference [4]; by tabulating the steps of the computation the risk of making arithmetical errors is much reduced. An example of the star-delta conversion need not be given since the method is similar to that used in the delta-star example above. The short cut, when two arms have the same phase angle, may still be used.

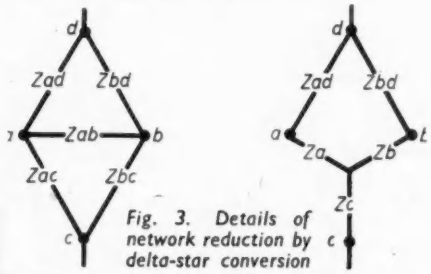


Fig. 3. Details of network reduction by delta-star conversion

Since some standardisation of cable types and sections is found in power networks, it is not necessary to work out in full the changes to polar form for every cable length; once for each type is sufficient. Likewise, for the parallel connection, the reciprocals may be found for each cable type, then used for other lengths by noting the admittance is, of course, inversely proportional to the length. But, even with the aid of these devices, the computation of symmetrical short-circuit currents including the effect of resistance is tiresome; though it is better to face up to the arithmetic required by the "exact" method, than to use an approximation which is not justified.

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ENERGY FOR INDUSTRY

Incorporated Plant Engineers discuss Fuel Topics

ENERGY for Industry was the subject of a weekend conference organised by the Incorporated Plant Engineers at Dunblane from October 5 to 7. The technical sessions on Saturday were opened by the President, Mr. D. LACY-HULBERT, who said that the subject had been chosen because of Britain's need to see that sufficient energy of the right kind was constantly available for ever-growing production output. He went on to make the point that to effect the same economy as that made by saving one man's wages for a year, it was necessary to save about 120 tons of coal or in terms of electricity, to eliminate a 60 h.p. motor. In most industries it was much easier to economise on manpower, and that was what was happening.

Economy in human effort through wider mechanisation was making necessary more coal and electricity, and it was here that the great problem needing solution existed. Economies in human effort could produce a 10% increase in productivity if coal, electricity and raw materials were available.

Fuel Policy

On Sunday the conference was addressed by Mr. L. G. NORTHCROFT, O.B.E., speaking on "Coal and Europe." He painted a picture of the effects on European economy of the cessation of coal exports from Great Britain, and suggested that this country was effectively exporting a coal shortage. The long term need was for a national fuel policy which would save 20 million tons of coal a year. A committee had been set up to advise the Minister of Fuel and Power on this point, but the first mistake made was that it was not appointed by the Treasury : this, because its recommendations would have to run over the boundary lines of a large number of Government departments.

Tax Remission

Points from a fuel policy selected by Mr. Northcroft included : discouragement of electrical space heating because of its alleged 18% overall efficiency; the earliest possible electrification of the railways, starting with the suburban lines and extending over the years to the main lines; every encouragement to be given to the installation of back-pressure generating sets, and as a corollary to this, all approved fuel efficiency schemes to be a permitted charge on revenue. This last point was reinforced by the suggestion that, if tax remission from our internal budget enabled coal to be exported, and help given to our external balance, it might not prove an unattractive proposition from the Treasury angle. There was also the point that the bargaining position in trade agreements would be much strengthened.

The final suggestion made was for harder work by everyone, the miners as well, and for more miners, Italian if necessary, in that British subjects were unwilling to take up mining as a career.

Problems and Practice

IN ENGINEERING

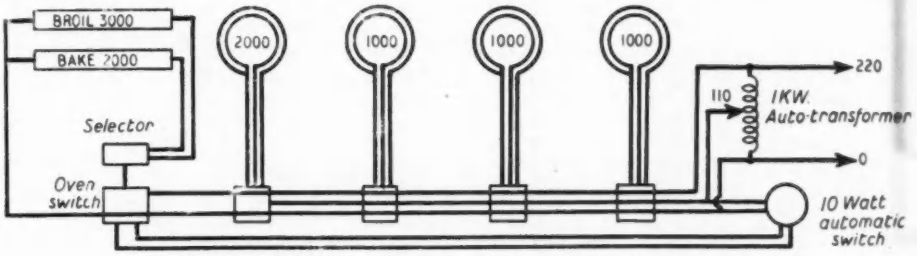
Adapting Cookers

WHILE working in Haifa, Israel, last year I was fairly frequently called upon to install domestic cookers of American manufacture. The method which was used locally may be of interest to readers who live in an area "under American occupation" and who may be required to adapt one of these appliances to British mains.

The normal American cooker is built for operation on a three-wire supply of 0-110-220V. It has one large plate of 2,000 W, two plates of 1,000 W each and a "Scotch cooker." The oven has a 2,000 W element for baking and a 3,000 W element for broiling. Many cookers also have a 10 W motor-driven automatic switch for time control of the oven, which is also fitted with a capillary-fed thermostat.

It will be seen from the diagram that the typical open-type cooking plate consists of two spirals as in some British cookers, but the switch has seven (occasionally five) positions. If all four plates were on the fourth heat the total 110 V load would be 1,250 W, and allowing for diversity a 1 kW transformer is usually found to be sufficient.

The mains pressure in Israel is 220 V, but the Palestine Electric Corporation does not allow a greater load than 15 amps per phase, so that all appliances with a greater rating are connected to a three-phase supply.



Details of switch and element connections for American cooker

One phase was used to feed the 110 V transformer, the second fed the 220 V positions on the four plates and the third was connected to the oven. Some cookers have a selector switch for the oven inscribed "broil-preheat-bake," giving a top plate-top and bottom plate-bottom plate connection. This switch must be altered to make it impossible for the two plates to be connected at the same time or a load of 5,000 W will result. The accessories, such as the cooker light, oven light and oven automatic switch, are all 110 V operated and need no alteration until the bulbs burn out. It is unfortunate that most of the 10 W motors driving the oven switch are made for 60 c/s use, so that a "conversion" table must be drawn up by the user.

The only transformers available in Haifa at the time were auto-transformers and they gave excellent service, although officially frowned upon by the Palestine Electric Corporation.

These installations have to the writer's knowledge always given satisfaction and are trouble free if a little care is taken in insulating the transformer from the heat of the oven.—*M. S. Bernstein.*

Dead Short

WHILST working on electrical maintenance in a power station, a call from the canteen kitchen one morning revealed that one of the cooker ovens had been working all night, although the oven switch was in the "off" position.

Immediately suspecting a short-circuit of the "live" and "switch" wires, I removed the cooker to the nearby electrical shop. Imagine my surprise, on dismantling the switch, to find a small mouse spread-eagled across the "line" and "switch" contacts. On removing the small intruder, who now seemingly was made of papier mâché, the cooker was again ready for service.—*J. W. J.*

Small Spring Hooking Tool

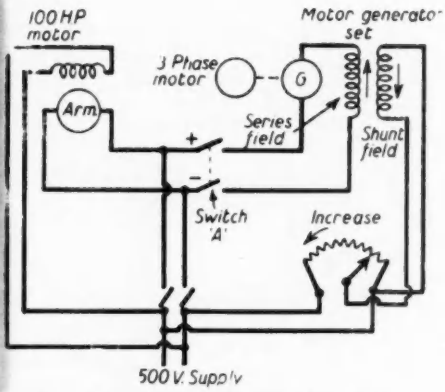
A USEFUL tool for hooking or unhooking fine coiled springs in various electrical apparatus motors, and control devices, can be made from a suitable length of drill rod or other suitable metal that can be dressed very thin and remain-strong. Flatten out one end of the length of rod required and shape as seen in illustration,

fitting into file handle. It is handy for removing broken springs and refitting new ones in awkward situations where there is little room. —*Ben Quarmby.*

Unwanted Automatic Reversing

I RECENTLY wired a 500 V 100 h.p. variable speed d.c. motor fitted on a large test rig. After initial running, long runs were called for at speeds below our minimum. We therefore had to alter the circuit to provide what was required.

Our answer was a second-hand motor-generator set connected as in diagram to provide the armature with the necessary lower voltage.



Connections for variable speed d.c. motor

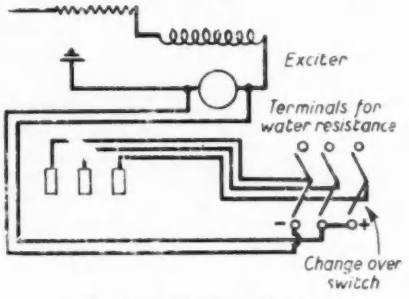
Having checked the polarity of the generator and the mains, we decided to test run; the result of this run was at first startling. After switching on the field of the 100 h.p. motor and starting the three-phase motor on the generator set, we closed switch "A," then turned the potentiometer to bring the generator volts up to enable the 100 h.p. motor to start. The armature of the 100 h.p. motor started turning in the right direction, within a couple of seconds it reversed on its own, then again; so it went on first one way then the other, with no one touching the controls. This had us shaken for a few minutes, then a quick test confirmed our suspicions. The generator was differentially compounded, and with a weakened shunt field the series field took over, completely reversing the polarity and collapsing itself, leaving the generator to pick up again on the shunt field and repeat its cycle.

Changing the ends over on the series field was the quickest answer and soon put things right.—*J. W.*

The next problem has been selected from this week's postbag of technical queries for the "Electrical Times" editorial staff. Readers are invited to submit their own solution: any replies printed will be paid for at our standard rate.

Lost Excitation

A 350 H.P. synchronous motor was found to be running with no excitation. Upon applying 24 V to the exciter field it built up to its normal voltage and the motor was started up (as induction motor with water resistance), changed over to excitation and run as a synchronous motor with 26 V 220 amps showing. I noticed that the exciter was sparking at this point and 20 V was tried. At



Synchronous motor controls

this point the load was applied and the voltage fluctuated between 0 and 20 and a.c. current went up and down with it. Only when brought back to 25 V did it work correctly. I was informed that the charge engineer had given orders to work at 22 V and keep the load light. Someone had disobeyed orders, and I think the excitation had dropped, allowed the motor to run as an induction motor, injected a.c. into the exciter, ruined the field and used the exciter as a portion of the rotor circuit (two rings being used as the positive portion and one ring as negative). Is my solution correct or has any other reader the solution? Incidentally, the armature was changed next day due to bad grooving.—*D. F. W.*

The Study of Natural Lighting

The I.E.S. Presidential Address

THE importance of daylight was becoming more generally recognised, said MR. J. G. HOLMES, A.R.C.S., B.SC., F.INST.P., F.I.E.S., in his Presidential Address to the Illuminating Engineering Society. While many of their activities in the past had dealt with subjects of direct interest to the lighting industry, more attention was now being given to the fundamentals of good lighting practice and to the whole process of seeing such as field-of-view engineering, contrast and revealing power, and the physiology of vision.

Mr. J. G. Holmes

Most of our seeing was done in daylight and our eyes were adapted for that purpose, he continued. If humanity had evolved in a uniform illumination of 10 lumens/sq. ft. they would have been quite different. We found that we liked to see out of a window when indoors if only to see the roofs and walls and windows of other buildings. An architect had many things to consider when designing windows—the appearance of the building, the layout of the rooms, the views into and out of each room, the admission of sunlight and fresh air, the loss of heat—and with all these he was asked to combine the requirements of good lighting inside the room. An illuminating engineer should be able to give sound advice on daylighting and an architect should be able to consult him on this subject with as much confidence as on artificial lighting.

The requirements for daylighting and artificial lighting were sometimes thought to be quite different and this was certainly true of some rooms which serve different purposes by day and by night. Most rooms, however, were used for specific tasks, as in offices and factories, and there was no fundamental reason why the provision for artificial lighting should be different in its effects from that for natural lighting—in fact most installations were used to supplement daylight in the morning or evening. The development of fluorescent lamps which blend extremely well with daylight had led to rapid progress in the combination of natural and artificial lighting, and in a few instances, such as Room 21 in the National Gallery, the ordinary observer did not notice any difference between the two.

Window Design

The matter of light distribution, however, was quite different. Neither the daylighting expert nor the installation designer knew exactly what was wanted, although the latter was probably able to get nearer the best result. Now, both of them had a common problem; what was the best way of mixing daylight and artificial light?

During the present century the character of windows had changed and search was being made for the proper relationship between the admission of sunlight and daylight and the needs of ventilation and clear vision. The thick glazing bars and heavy windows of the Victorians had given place to generously proportioned windows with large clear panes and freedom from unnecessary obstructions. Although the modern architect still tended to regard the art of fenestration as being the proper arrangement of the pattern of window openings on the face of the building, he was now able to build his windows so that the rooms were well lit because he had at his disposal a wide variety of building methods and structural components which helped him to give attention to the demand for more light. It was only during the last forty years that the idea of proper distribution of daylight had received much attention and the full application of the figures which could be calculated had not yet been sufficiently studied. The process of designing windows was still in a state of development and many of the remaining problems related to imponderables, such as the subjective visual and psychological effects, as well as the ordinary problems of brightness distribution.

Diffusing Methods

The use of a patterned window glass might have a considerable effect on the illumination in the parts of a room from which the sky was not directly visible and might greatly increase the daylight factor. A lightly diffusing glass could spread daylight usefully farther into the room; a strongly diffusing glass could throw

light strongly towards the back of the room with some risk of glare. The use of diffusing windows, glass bricks or other translucent panels introduced certain psychological problems and there would appear to be a useful field of study here for the illuminating engineer.

The use of Louvres

Another aspect which should be given further study was the use of louvres. The walls and ceiling of any room acted as louvres to obscure the principal sources of daylight and architects had always employed the thickness of the wall or building or trees outside to reduce the direct glare from windows. Illuminating engineers were perhaps more familiar with louvres in connection with shielding artificial light sources but in the design of buildings for daylighting the louvre methods had generally been based on the diffusion of light and the reduction of contrast, a lesson which we were only just learning in artificial lighting.

Apart from a few individual workers there did not seem to be a great deal of activity in this country on daylighting research at the present time though other countries were showing a much greater interest. It was perhaps to be expected that the greater part of the research into daylight should be undertaken by official organisations such as the D.S.I.R. but it should be considered whether our industrial illumination laboratories and our organisations concerned with the manufacture of window materials ought to take a greater part in this research. Lighting engineers had tried to make easier the lot of the common man, concluded Mr. Holmes, but they had often only given him more and more artificial lighting—surely we owed it to him to devote some of our knowledge and experience to the proper use of natural light? Windows had a much greater life than lighting fittings and architects and lighting engineers should collaborate to get the best lighting conditions from them.

Yorkshire Board Prosecution

Defendants committed for trial at Leeds

AFTER a hearing lasting seven days, the Yorkshire Electricity Board, as a corporate body, was committed for trial at Leeds Assizes on eight summonses alleging unauthorised building operations at the Board's headquarters at Scarcroft. The prosecution submitted that the Y.E.B. had overspent to the extent of £41,217. The Board's chairman, Col. W. M. Lapper, and deputy chairman, Mr. F. Newey, were also committed for trial on charges of aiding and abetting in the commission of these offences. All pleaded not guilty and reserved their defences.

Continuing the prosecution's case, much of which was reported in our issue of last week (page 622), questions were asked about clocks, heating and television sets installed in the extensions. Mr. G. A. Farthing, chartered electrical engineer and assistant to the Board's commercial department, said the buildings were to be heated by an electric thermal storage system which would mean duplicating the one already ordered. He was instructed to arrange for that duplication. At a "progress meeting" in October, 1949, it was decided to install panel heating throughout the extension except in the kitchen and caretaker's flat subject to Mr. Newey's last word. Later in proceedings a heating engineer said he had never been concerned in the installation of such an expensive system of heating in offices as the combination of thermal storage heating with panel heating. He agreed in cross-examination that the system would effect a saving of 25% on fuel.

As regards the clocks, Mr. Farthing stated that the total cost of the system, involving four faces, a master clock and a "slave" clock, was about £460, and wiring about £70. Only one television set had been installed at Scarcroft until recently, and three rooms had been fitted for television. This work was not in the normal scope of his duties and the majority received authorisation.

Mr. G. W. Warrilow, a master builder, told the court that he and his men worked at Scarcroft between August, 1949, and May, 1950. His final account was £39,006, of which about £1,000 was for repairs and maintenance. The clerk of the works at Scarcroft, Mr. A. W. Long, said under cross-examination that only four men worked over one week-end about Whitsun, 1950, the total cost being about £50.

The Board's chief accountant, Mr. E. Van Ham, said that prior to the Ministry of Fuel and Power's inquiry no differentiation had been made between authorised and unauthorised work. Replying to questions by Mr. W. R. Hargreave, for Newey, he said that at a meeting of the Board in February, 1950, expenditure of £50,150 was approved, which included non-authorisable work. In June, the amount spent on various schemes was £88,000. Of this £65,700 was spent at Scarcroft, including the heating plant. Mr. Van Ham, asked on what authority that expenditure was exceeded, said no specific authority was required. The difference between the two figures was regarded as chargeable to revenue, and that was the reason why the excess was not brought to the notice of the Board.

Research on Show

E.R.A. stages Series of Open Days at Perivale

TECHNICAL reports published at irregular, if frequent, intervals give most engineers their impression of the work carried out by the British Electrical and Allied Industries Research Association. For those who have the opportunity to study them, the Annual Reports give a more balanced overall view of the Association's activities, but the best way of appreciating their wide range—seeing what is going on—had not been offered from 1935 until this week. Now, however, to demonstrate to members what has been achieved, and how much more might be managed in more spacious quarters, the Council and Director of the Association have arranged a series of open days at the Perivale Laboratories.

Progress

Before attempting a description of the experiments and instruments which are being shown to visitors, it may be helpful to note briefly the progress of the Association since October 1935, when the late Duke of Kent opened the Perivale establishment. In that jubilee year, the income of the E.R.A. was £66,000; in 1950, it was £216,000, a measure, after allowing for increased costs, of a remarkable widening of activity. Not all this work is carried on in the Laboratories and out-stations, with their 300 strong staff. Many of the more fundamental investigations are conducted on an extra-mural basis, with co-operation from universities, government establishments, and other research organisations. Such activities are represented in the open day displays by appropriate exhibits included in the temporary marquee which gives an overall survey of E.R.A. work.

Since so much of the Association's attention has been given to the development of reliable materials and the determination of their properties, it is appropriate that this work should be well represented. Most of the work on magnetic materials has been carried out at the Universities (Cambridge, Sheffield and Nottingham) and by the N.P.L. and the Permanent Magnet Association. All types of dielectric materials have been studied at Perivale, while outside work is being supported on the solid state (Bristol, Liverpool and Imperial College), the liquid state (Birmingham) and on discharges in gases (Liverpool, Imperial, Queen Mary College, Oxford and Durham).

Gas discharges, of course, lead into problems connected with ignition, switchgear, and welding, and so the work spreads over several divisions, all of which may benefit from some advance in fundamental knowledge.

Another activity conducted, of necessity, away from Perivale, is the study of wind power and rural electrification. A collection of models and photographs, showing the position reached in the work, include those of various types of wind generator, including the 100 kW designs for Costa Hill, Orkney (John Brown and Co.) and Mynydd Anelog, Caernarvonshire (Enfield Cables,) Various anemometers are also shown, including a gust-measuring instrument with a response time of 0·1 second.

The exhibits connected with rural work cover a wider range. Crop drying for the arable farmer, soil warming for the market gardener and an automatic hammer mill for the herdsman are all the subject of E.R.A. research and development.

Library services and an information bureau are features of the Association's service which are of special value to members in their own work, and an attempt is made to represent the organisation necessary to the working of such a scheme. Other subjects difficult to present in the form of models or instruments, include participation in national and international organisations, work on education in the electrical industry, mathematical investigations, basic work on earthing, and incidental contributions to the science of instrumentation.

Research Apparatus

In the marquee, it is possible to obtain a broad outline of the research activities, in the laboratory proper current work and the apparatus which facilitates it can be studied in more detail. For example, amongst the exhibits in the magnetic section are demonstrations of powder pattern techniques as used in the study of magnetised single crystals, and a balance which is used for measuring the stability of permanent magnets.

Some 37 exhibits present information on insulating materials, and it is possible to mention only a few of special interest. These include photographs by the Schlieren technique of temperature distributions in lamp fittings, photo-micrographs of faults in capacitor tissue, special photo-emulsions for detecting

sub-microscopic cracks in conducting glazes and conducting faults in aluminium oxide films, and photo-micrographs showing dielectric erosion and breakdown caused by internal discharges. All these examples deal with practical problems, but more basic research is also well represented. An example is given by a sample of insulation designed to eliminate all secondary causes of breakdown, and so having an electric strength of the order 5 MV/cm at room temperature; again, by apparatus for the investigation of structural changes in dielectrics at pressures up to 1,000 atmospheres; and, finally, by an electrode system being developed for the measurement of dielectric properties at frequencies up to 100 Mc/s and temperatures in the range −180° C to +150° C.

Switchgear

Research on switchgear and control gear has the largest showing in the open day display, a centre of interest being the switchgear testing control room. Films are being shown here to illustrate the value of high speed cine photography in the study of arc phenomena.

In circuit-breaker studies, field work is of first-rate importance, and the E.R.A. recollectograph, which uses magnetic recording, is of value in obtaining a measurement of transients occurring without warning. Also shown is a multi-element c.r.o., trailer mounted, which has been used in the recent researches on rate of rise of restriking voltage.

Medium voltage protection has its representation in researches on air break contactors and fusegear. Experimental set-ups for fundamental work on contact wear are on view, whilst in the fuse section there are examples of specialised measuring apparatus, including a c.r.o. control unit for use in obtaining records when the fuse melting time is considerable.

Power Supply

High voltage direct current transmission has attracted much attention in recent years, and an interesting exhibit here is a model transmission system, working at 2 x 600 volts, 10 amp, which can represent lines, terminal equipment and protective apparatus of a system with up to 600 miles of cable or 1,050 miles of overhead lines. More orthodox transmission methods are represented by two groups of cable exhibits. The first includes an arrangement of trunking and fans, used for the determination of ratings of overhead cables at low-wind speeds, and also equipment for the study of steel wire (increasingly used as a conductor) with a view to the ready prediction of its impedance. Main concern of the second group is the effect of short-circuits on cables, and here the work ranges from the determination of transient heat losses and the limitation imposed by sheath fault currents, to the checking of the buckling forces imposed on joints.

On the model scale, once more, there is the pilot model of a network analyser which can be used either for steady state or for transient studies and apparatus for detecting incipient faults in the insulation of installed electrical equipment. Radio interference is another subject of current interest which is represented in this section.

Transformers and their behaviour under all conditions of system working have been the subject of much attention at Perivale and oil, noise and surge characteristics are amongst the facets of the problem demonstrated. An interesting section here is that showing an experimental transformer, having two identical disc windings, controllable as to degree of asymmetry; this is used to check the simplifying assumptions made in developing a mathematical method of checking short circuit stresses.

Finally so far as this section is concerned, must be noted the work on power plant materials. Work on the creep of alloy steels and on their corrosion characteristics is represented by examples of components removed from use, and by photographs. There is also representation of apparatus being constructed at Imperial College to extend the range of the steam tables to 6,000 lb/sq in., 1400 ° F.

Utilisation

Two sections dealing directly with the utilisation of electric power (space and water heating, and welding), and one indirectly (ignition research) remain to be described. In the first category, beside the well-publicised heat pump, is an exhibition showing the study that is being made of electric floor heating. Several such floors, which are being used to heat small commercial buildings on an off-peak basis, are the subject of study. Electric water heating is the subject of two further exhibits in this section, one dealing with the circulation of water during heating up and during drawing-off, and the other with scale formation on electric immersion heaters.

The welding section demonstrations include work on the argon arc welding of non-ferrous metals whilst radio interference measurements are presented in the ignition display.

DIRECT EARTHING and WATER MAINS

IT IS IMPORTANT TO CHECK THE COMPLETE EARTH LOOP RESISTANCE

says **A. E. CROFT**

PRESENT-DAY practices in the laying of water mains the methods of jointing and the increased use of composite pipes, has created a situation where an urban water supply cannot be accepted as a satisfactory electrode for direct earthing purposes unless suitable

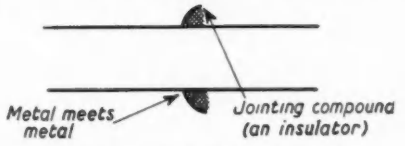


Fig. 1. Jointing of metal water mains

tests have been carried out to ensure that the fault impedance path is low enough to satisfy I.E.E. Regulation 1005.

In the laying of water mains the following combinations may occur : (a) Composite and metal pipes in the same area e.g., one side of a street, composite—the other, metal. (b) An area fed by a composite pipe with metal distributors and lead or copper services. (c) An area fed by a metal pipe with composite distributors and lead or copper services. (d) Relaying of old metal by composite pipes. It can be seen from (d) that supplies which have been

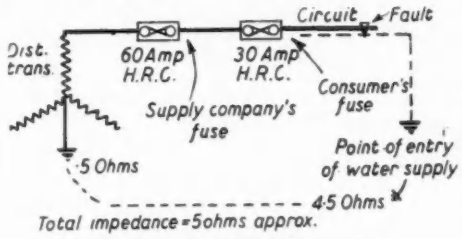


Fig. 2. Example of earth loop circuit

connected for some time and have had a satisfactory electrode may be suddenly left isolated. On metal mains the joint being used to a large extent now is as in Fig. 1 and, although metal meets metal, as the pipes are usually spun in bitumen after manufacture, resistance tests across joints, with trenches closed and water at 60 lb/sq in., give values of the order 6-12 ohms. These high resistance joints prevent the obtaining of the required amount of solid metal that is necessary to ensure good contact with earth. Investigation carried out over an urban area of 20 square miles approximately, using metal mains jointed as Fig. 1 showed that impedance paths of as high as 5 ohms, were common (h.t. and transformers and l.t., both underground armoured).

It is, therefore, essential that electrical contractors should, when installing a new installation or adding additional circuits to an existing installation, carry out earth tests to ensure

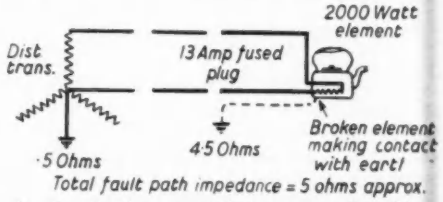


Fig. 3. Another unsatisfactory case of earthing

that the water supply when used for direct earthing of apparatus provides the necessary low impedance fault path. The simple examples Fig. 2 and Fig. 3, taken from actual faults which have occurred, will illustrate how dangerous conditions can arise.

Case 1.—An earth fault on the circuit caused by screw being put through phase and earth wire when re-laying floor boards. Fault current $= \frac{220}{5} = 44$ amps. Voltage dropped at fault $= 44 \times 4{\cdot}5 = 198$ volts. Voltage dropped at transformer $= 44 \times 0{\cdot}5 = 22$ volts. The 30 amp. fuse is capable of maintaining this fault current for over 100 minutes and the potential at the water tap will approach 198 volts above earth, also affecting other water supplies in the vicinity.

Case 2.—An electric kettle will break half way along element and phase side of element making contact with earth at break. 2,000 watt element at 220 volts = 24 ohms approximately. Impedance of element still to phase = 12 ohms. Impedance of earth path = 5 ohms. Total impedance = 17 ohms. Current under fault conditions $= \frac{220}{17} = 13$ amps. The

sub-fuse in the plug will maintain the fault and raise the potential of the kettle to 4·5 × 13 = 58 volts above earth.

The fault in Case 1 revealed itself almost immediately by smoke coming from the floor boards. The fault in Case 2, was discovered when complaints were received that water-taps were alive and effecting three or four houses.

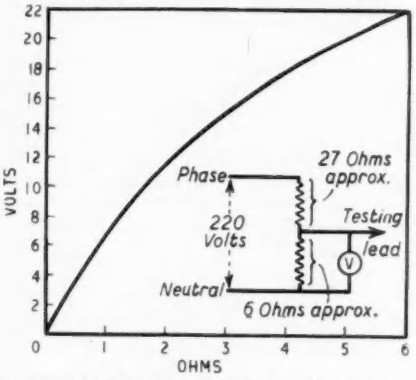


Fig. 4. Calibration curve for earth resistance testing procedure

The methods of testing to be adopted will of course depend on if a supply is on the site and the instruments available. The heavy current at low voltage method using a double wound transformer is very satisfactory. Unfortunately these instruments are heavy and expensive. A method which is simple in operation and gives good results when a supply is available is as shown Fig 5.

A nickel chrome element of 33 ohms tapped as shown, can be wound on a porcelain former and accommodated in a small tin box. A voltmeter, 0-10 V;0-50 V. is also needed. The voltmeter reads 40 V on open circuit and collapses to zero when the 6 ohms resistance is shorted by a zero earth path. A graph, Fig. 5, can be prepared showing volts against ohms where ohms is the value of the complete fault path impedence. This arrangement is simple and very easily carried, the importance of ensuring that the phase wire is connected to the correct end of the element has to be impressed upon those responsible for operation.

In new housing estates where the value of the earth impedence may be high, improvement can usually be obtained by strapping the water services; strips should be laid fairly deep so that there will be no interference with them when the garden is receiving attention. Small circuit breakers combining overload and earth leakage protection are very satisfactory. In view of the increased use of water heating

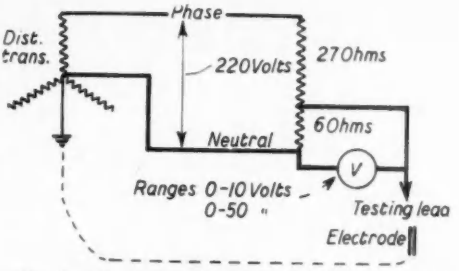


Fig. 5 Circuit for checking earth loop resistance

equipment which is piped to the supply, circuit breakers combining overload with core balance earth-leakage protection should have the attention of manufacturers.

ELECTRICAL FIRE ALARMS

LATEST British Standard Code of Practice to be issued is that dealing with electrical fire alarms, which bears the classification CP327,404/402,501(1951). It forms part of the series dealing with electrical installations in buildings, and makes no attempt to deal with public fire-alarm systems, or alarms forming part of automatic sprinkler installations.

Under the heading "design considerations," the point is made that the equipment and wiring of the fire alarm system should be special to that system.

Both closed and open circuit working is acceptable for the system, though closed-circuit is preferred. Earth-return circuits are expressly disfavoured, and in all cases, some form of fault signal is called for, to indicate trouble on the installation. The normal voltage at which the system operates should preferably not exceed 100 V and in no case should it exceed 250 V. The system, including all its components, should function satisfactorily in all respects should the voltage fall to 8% of normal.

Power supply for fire-alarm systems should be primary or secondary batteries, the capacity of each being such that it can maintain the maximum alarm load on the system at an adequate voltage for at least two hours, with additional capacity to deal with the standing load losses. To minimise the risk of failure, the use of fuses and/or circuit-breakers should be kept to the minimum consistent with safety.

Wiring systems inside buildings are limited to mineral insulated metal sheathed cables 1/·044 in. or larger, v.r.i. or p.v.s. of 3/·029 or larger in conduit, or hard metal sheathed cable 3/·029 or larger. The use of external overhead lines is strongly depreciated, but various types underground cabling are permitted.

The Code of Practice is published by the Council for the Codes of Practice for Buildings, and may be obtained from the British Standards Institution, 24 Victoria Street, S.W.1, price 5s. post free.

Generation in U.S.A.

Cost Survey reveals some Interesting Trends

TRENDS in American steam station design, and especially the economic considerations which affect them, have recently been the subject of a comprehensive review in our United States contemporary, *Electrical World*. Many of the figures quoted, in particular the comparisons with pre-war costs and practice, are of interest in relation to British experience.

Before actual figures are discussed, some important differences between the industry in the two countries must be emphasised. First of all, there is the availability of natural gas in some parts of the U.S.A., which forms an attractive and readily handleable fuel. Oil, too, is more widely used than at present here, though in spite of these facts, coal remains the principal fuel in the majority of stations. Where coal is used, its calorific value is on average, higher than in this country. Climatic conditions are another important variable, outdoor boiler houses and fans being fairly common, as will be apparent when the figures are quoted.

The survey summarised here dealt fully with 48 post-war stations, covering a wide range of installed capacity. A start may well be made with that traditional parameter, cost per kW installed, and here it should be noted that these American figures are based on the capability rating of the sets, rather than on some more or less arbitrary manufacturer's description. For plants of more than 20 MW capacity, the general cost range is $145 per kW, say £52. For coal-burning plants alone, the average works out at $150/kW, i.e. £54. At this level, pre-war costs are exceeded by some 70%. Extreme values recorded in the survey are $80/kW for a gas burning station with outdoor boilers, and $300/kW for a small coal fired plant of traditional construction.

Fuel costs, on a basis of available heat, ranged from 3·5 c to 35 c/million B.Th.U. (3d. to 2s. 6d., roughly). Some fuel costs represent 75% or more of works costs, there is a similarly wide range in that figure, but averaged over the whole data one kWh of energy at the station busbars costs 0·365 c for production and 0·475 c for fixed charges, giving an overall total of 0·84 c, or 0·72 pence.

Of the 48 stations studied for the survey, 20 have their boilers entirely or partly out-of-doors, an instance of the way in which designers are combating rising constructional costs. Other points of note in this connection are the use of metal and composite panels for making up outer walls, and the substitution of metal grills for poured concrete floors, especially in turbine houses.

Better thermal efficiencies are aimed at by the use of higher temperatures and pressures. Heat rate, in B.Th.U./net kWh ranges from 14,500 with 600 lb/sq in. steam to under 11,600 with 1,500 lb/sq in. steam and reheat. Over half the post-war plants surveyed came within the range of steam pressures 820 lb/sq in. to 950 lb/sq in., and some 30% are included from 1,250 lb/sq in. to 1,500 lb/sq in. Overall thermal efficiency naturally shows some variation with size of plant, and for coal stations ranges from 23% in the 0 to 19 MW range, up to 33% for stations above 150 MW installed capacity.

Plant maintenance costs have been carefully analysed against plant size, but they show relatively little variation in this respect, a representative figure being 0·25 c/kWh generated. In most station size groups, boilers accounted for the largest single maintenance item.

Employment in power stations showed a 2 to 1 range, from 1 man/MW in small plants to half a man/MW in the largest stations; this on a basis of payrolls. In stations of 100 MW and above the actual variation in men/MW is in the range 3 to 1.

BRITISH STANDARDS

LIMITS OF RADIO INTERFERENCE.—B.S. 800: 1951. Price 3s. Several important modifications to the original standard of this title have been made in preparing this edition. The most notable is a simplification of the technique of terminal voltage measurement. Increased knowledge has made possible the substitution of a method based on the measurement of noise voltages between each line terminal and earth, rather than a complicated procedure involving "symmetrical" and asymmetrical components. For various reasons there has been an increase in permissible upper limit of terminal voltage from 500 to 1,500 microvolts, and a rearrangement and simplifying of the method of sampling for the measurement of continuous types of radio noise. Clauses dealing with discontinuous and intermittent types of noise have been revised, and a method of sampling introduced. Finally, there is relegation to an appendix of the proposed radio-interference-free mark.

NEW LITERATURE

Electrical Insulation, its Application to Shipboard Electrical Equipment

by Graham Lee Moses

THE author being the manager of the insulation development section, Westinghouse Electric Corporation, this book as may be imagined deals exclusively with American practice. Since trends in shipboard electrical equipment—higher temperatures, increased reliability, lighter weight, etc., are similar on both sides of the Atlantic, the book should be of considerable interest to British engineers. The subject is dealt with under the headings of insulation theory and basic concepts; classes of insulation and their properties; selection and construction; apparatus assembly and winding problems; varnish treating processes, tropical treatment and storage; testing; and preventive maintenance programmes. A valuable feature is contained in the last chapter, which is devoted to a "re-cap" in summarised form of the entire contents, with specific Do's and Dont's. Other valuable features are a glossary of terms, an extensive bibliography (not confined to American references) and appendices of insulating materials with properties and testing information. Containing 260 pp. (87 I) 10 in. by 7¼ in., the book is published by the McGraw Hill Publishing Co., Ltd., Aldwych House, W.C.2, at 47s. net.

Sound Film Projection

by F. W. Campbell, T. A. Law, L. P. Morris, and A. T. Sinclair. Edited by E. Molloy

THE fact that this book has run through four editions in six years endorses its usefulness to the sound engineer and the projectionist, covering as it does five well-known systems (R.C.A. Photophone, Gaumont-Kalee, British Acoustic, B.T.H. and Western Electric) in addition to a separate chapter on portable equipment, also a comprehensive study of maintenance fault-tracing, and repair work. There are additional chapters on sound reinforcement and public address equipment, while this latest edition includes an additional chapter on television projection for theatre work. Published by George Newnes Ltd., Tower House, Southampton St., W.C.2, the book contains 340 pp. (228 I), 9 in. by 6 in. at 30s. net.

Practical Wireless Service Manual

Edited by F. J. Camm

THIS, the ninth edition of this popular work, has been revised and to a certain extent brought up to date. The book is, in essence, a comparatively simple guide to fault finding, testing and realignment. Unfortunately, while the principles of the subject remain unchanged, modern manufacturing techniques and recent developments in valves and components have made these principles increasingly difficult of application. Thus many of the testing procedures outlined would be well nigh impossible to apply with any degree of success to a modern commercial receiver. A further criticism is that although the text has been revised, the line drawings are still of the pre-war era and illustrate components which, if not obsolete, are seldom found in these times. However, for the beginner who is starting by building his own receivers using straightforward circuits, without complexities such as multi-wave coil packs, tone controls, a.v.c., and so on, this volume will provide a thorough grounding in the principles of fault location and testing. Published by George Newnes Ltd., 288 pages. 5 in. by 8¾ in. Price 8s 6d.

The Electrical Power Engineers' Handbook

by W. S. Ibbetson

THE great virtue of this volume lies in the fact that it is fundamentally written and designed for the practical man—it is not a student's textbook. It deals mainly with the maintenance and handling of electrical machines—motors, generators and converters—although owing to the ever-increasing use of rectifiers, chapters are also included on this type of equipment.

The presentation is concise and clear, and no hesitation has been shown in using the question and answer technique where it has been found convenient. For the works' electrician and his staff, this book will prove an invaluable asset. Published by E. and F. N. Spon Ltd., 22 Henrietta Street, W.C.2. 298 pp. 5½ in. by 8½ in. Third edition, price 22s.

BOOKS RECEIVED

Alternating Current Machinery, by B. F. Bailey and J. S. Gault. Degree course text book on transformers, synchronous and induction machines, single and 3-phase. Published by McGraw-Hill, 421 pages, 9 in. by 6 in.

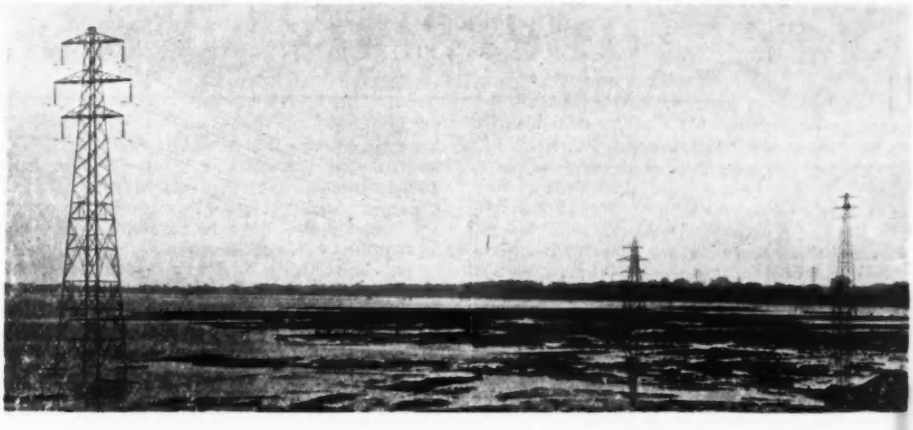
B.E.A.M.A. Guide to British Electrodes. Covers standard arc welding electrodes for welding mild steel. Published by the British Electrical and Allied Manufacturers Association, 30 Kingsway, London W.C.2. Price 2s.

Basic Electro-technics, by B. Goodlet. Electromagnetic theory presented for undergraduate standard students, avoiding the classical approach. Published by Edward Arnold and Co., 247 pages, 8½ in. by 5½ in. Price 21s.

Technical Sketching, by E. F. Walker. Hints on developing technique. Published by Pitman, 60 pages, 8½ in. by 6½ in. Price 6s. 6d.

Theory and Design of Valve Oscillators, by H. A. Thomas. Advanced textbook, part of the publishers' "monographs on electrical engineering" series. Published by Chapman and Hall, 317 pages, 8½ in. by 5½ in. Second edition, price 36s.

Electroplating and the Engineer, by A. Whittaker. Introduction for engineers: a "Mechanical World" monograph. Published by Emmott and Co., Ltd., 31 King Street West, Manchester 3.



The Nursling-Fawley 132 kV Line

W. T. Henley's complete 11-mile route passing through marshland

A DOUBLE-CIRCUIT 132 kV steel tower overhead line between the Nursling substation of the British Electricity Authority and the new Esso oil refinery at Fawley has recently been completed by Henley's for the Southern Division of the B.E.A.

The route of the line, approximately 11 miles in length, follows the west side of Southampton Water. The line conductors are 0·175 sq in. (37/0·110) S.C.A. and the earth conductor is 0·07 sq in. (19/0·110) S.C.A.

Henley's experience in erecting overhead lines in terrain subject to flooding stood in good stead in the construction of certain sections of the Nursling-Fawley line, for at Redbridge, Bury March and Fawley, the tower sites are flooded at high tide.

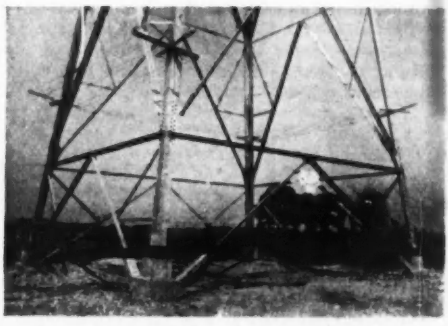
The steel towers, supplied by Messrs. Blaw-Knox Ltd., are of standard design excepting two towers at Redbridge. These carry the lines over the northern extremity of Southampton Water and they are both 154 ft 9 in. high.

The towers sited in marshland required special foundations, of course. The poor nature of the soil and the prevalence of flooding rendered piling necessary. This work was carried out by Pressure Piling (Parent) Co. Ltd., who employed their system of casting the piles *in situ* under pressure.

In order to effect economy in costs, and at the same time to avoid the use of abnormal quantities of concrete at foundation positions where the time for setting was extremely limited due to flooding, the piles were designed for the dual purpose of withstanding compressive loads and also to take tension loads to compensate for part of the tower uplift loadings. By the combined use of piles and of standard concrete pyramids and rafts, it was possible to reduce the depths at which foundations had to be set, and at the same time to avoid the use of excessive quantities of concrete.

Another feature of the foundations was the provision of concrete muffs surrounding the steelwork of towers up to high-water level at positions subject to flooding.

The refinery, which the line is supplying, was described at some length in our issue of September 20, and is in part production at the moment. It is expected to be in full production by the end of next year.



Concrete muffs protect the lower members of the towers. Our heading picture shows the kind of territory that Henley's Engineers had to contend with in building the line

overseas news

U.S. Plant for Australia

America is to ship to Australia by next August, power plants of a total capacity of 190,000 kW, Mr. H. G. Conde, chairman of the New South Wales Electricity Commission, stated recently. Of the plant ordered in the U.S.A., New South Wales would get plant amounting to 140,000 kW and the rest would go to Victoria and Queensland. Mr. Conde said he had to assure the United States authorities that Australian powerhouses would be ready to instal generating plant immediately on its arrival there. "And the Americans had a comprehensive file about the progress being made on Australian powerhouses," he added. Mr. Conde also said he was in favour of buying a floating power ship.

£15m. Hydro Schemes in Tasmania

The Tasmanian House of Assembly has now passed the Bill which empowers the Hydro-Electric Commission to borrow £15,800,900 for the development of two new stations at Lake Echo and Wayatinah below the Tungatinah station.

Frequency Changeover in Perth

First area in the metropolitan area to be changed from 40 c/s to 50 c/s supply will be South Perth. The team has been working for some time now in the Brandon, Addison, Menas and Coonde Streets area. Next area to be converted to 50 c/s supply will probably be the southern section of Victoria Park.

Power Project Workers Sacked

Two thousand State Electricity Commission construction workers have been dismissed following the drastic cuts in Victoria's public works programme ordered by the Loan Council. Announcing this, Mr. R. A. Hunt, S.E.C. chairman, said that 1,500 men on the Kiewa project, 500 men working on the new brown coal and briquetting station at Morwell and 200 men in line construction gangs would be affected. As a result, all construction work on the Kiewa project except No. 4 station will cease. The new Shepparton and Warrnanibool stations now nearing completion will be delayed.

Scale Model Advantages

Practical studies carried out with a hydraulic scale model of the Niagara River have saved the Hydro Electric Power Commission of Ontario an estimated total of $5 million to date in preliminary construction work on the huge Sir Adam Beck-Niagara No. 2 generating station, Mr. Richard L. Hearn, the Commission's general manager and chief engineer, disclosed last week. Mr. Hearn was addressing a special dinner meeting of more than 300 members of the American Institute of Electrical Engineers. Tests had shown how to design the tunnel intake above the Falls so as to prevent interruption of water flow by river ice during the winter and spring, and by reconstructing the actual conditions that would be met, model engineers were able to design an intake installation quickly, and without carrying out "trial and error" schemes on the river bank site.

Extensions at Saskatoon

The forthcoming programme of extensions at the Saskatoon plant has necessitated the separate appointment of a design and construction superintendent. Details of operation and construction had been separated and Mr. A. Bolson, former plant superintendent at Saskatoon, has been appointed to the new post. Present capacity at Saskatoon is 38 MW. With the installation of a new turbo-generator in 1952 capacity will be increased to 63 MW. Also in the extensions programme is a further addition of a 250 klb per hour boiler in 1953 and a further 25 MW unit in 1954.

Natural Fuel

The Saskatchewan Power Corporation is investigating the possibility of establishing a power plant, using natural gas as its fuel, in the Lone Rock area, near the Alberta boundary, Mr. J. W. Tomlinson, corporation general manager, has said.

Manufacturing Development

At St. John's, Quebec, the first Canadian factory for Brown Boveri (Canada), Ltd., subsidiary of the Swiss firm, is now under construction. Manufacturing operations are expected to begin late this year and initial production will include distribution and power transformers, air blast circuit breakers and switchboards. It will employ about 200 workers along with some 35 technicians, who will be brought from Switzerland.

Plan for Italy

Italian electricity undertakings—including municipal authorities, organisations generating their own current, the Italian State Railways, and others—are collaborating with the Italian authorities in drawing up a programme of new installations, which is to supplement the 1948 "National Programme." The limitations on the scope of the programme are likely to be financial rather than technical, it is understood. The electrical programme of the Institute for Industrial Reconstruction alone is to cost 100,000 million lire, of which 75,000 million will be spent

in the two years 1951-52. At the end of 1950, Italy's total installed generating capacity (both hydro-electric and thermal) amounted to 8,562,000 kW, compared with 8,047,000 kW at the end of 1949. Of this total, 7,433,000 (7,008,000) kW was located in Northern Italy and 1,129,000 (1,039,000) kW in the Southern part of the country. The increase in generating capacity since 1938 amounted at December 31, 1950, to 41·5% in Northern Italy and 59% in Southern.

Another Rival

Determined efforts are being made by German manufacturers of electrical products to get a footing in the Swiss market. They are, however, not meeting with much success, according to current reports. They cannot compete with the Swiss manufacturers as far as purely electrical equipment and accessories, such as switches, wires, transformers, etc., are concerned. In the household equipment sphere they are endeavouring to increase their limited market in washing machines, vacuum cleaners, refrigerators and similar appliances. Their washing machines, refrigerators and vacuum cleaners are said to be inferior in quality to the British and American counterparts, and although German prices are lower, local distributors do not contemplate much trouble. Cookers and electric stoves, however, are increasing in sales as the German design appeals to the habits of the Swiss housewife. The prices of German commutators are in many cases cheaper than those of British manufacturers, and the Germans offer delivery in about six to seven weeks—considerably less than most British concerns, it seems.

Mekadatu Power Project

Final touches are being given to the draft agreement between the Mysore and Madras Governments in respect of the Mekadatu hydro-electric project sponsored by the Mysore Government. Mekadatu is in Mysore State on the Mysore-Salem borders and the scheme is designed to establish a reservoir there and impound the Cauvery waters and erect a 36,000 kW hydro-electric station at an estimated cost of Rs. 50,000,000. Power will be sold to Madras under the agreement yet to be settled.

Rural Electrification in India

The Ahmedabad Electricity Co. is now proceeding apace with its rural electrification plan. The villages of Naroda and Sejpur Bhoja were recently connected up, and attention is now being turned to Sarkhej. Though the chief engineer and manager of the company, Mr. K. N. Paulin, and his deputy, Mr. J. D. Patel, are busy with their scheme for the city, giving about 500 new service connections per month ward-wise to wipe out long-standing arrears, they have completed their plans for Sarkhej and providing there is no hitch in obtaining the necessary equipment, electrification of that village should be completed by the middle of 1953 when the other seven villages on the list will be taken in hand.

Pennar Plans Revised

The Madras Government has drawn up a revised scheme of Rs. 1,330 million for the Kistna-Pennar project. Under this, the project is to consist of two dams, one on the Kistna river at Siddeswaram and the other on the Pennar river at Someswaram, forming two reservoirs with a total capacity of 55,000 million cu ft. Power will be developed at Byth through hydro-electric turbines with an installed capacity of 250,000 kW. It is proposed to split the plan into two stages, the first stage aiming at irrigation of 2·1 million acres for a capital outlay of about half of the total cost on the irrigation site and the full outlay on the power plant side of the dams.

Hydro-Electric Developments in U.S.S.R.

According to recent Soviet official and semi-official sources proposed schemes at present under discussion will, if adopted, involve changing the course of several major rivers in Siberia in order to make them flow southwards to irrigate the desert area of central Asia.

Main feature of the proposal is the building of a dam 78 metres high on the River Ob, just below the confluence of the Irtysh. The gigantic reservoir or Ob Sea thus formed will reach to the Turgai plateau. A 900-km canal would be cut through the plateau so that the waters would pass through the Aral Sea to the dried up channels of ancient rivers in Central Asia. The river Genissei would be led in to the lower Ob in order to increase the volume of water which would drive a large number of hydro-electric stations as well as irrigating Central Asia and Kazakhstan.

The completion by the Stalin Works at Leningrad of a third large turbo generator for the Tsimilyansk power station on the River Don was announced recently by the Tass Agency. Last month the waters of the River Don were diverted into a canal to run round the dam eight miles long which is under construction at Tsimilyansk.

Hydro Plant at Waiau

Moves towards the formation of a Southland Electric Power Board and the development of the South Island Hydro power potential are being made by certain organisations in the Dominion.

Dr. W. B. Reekie, of the Otautau Progress League, backed by his fellow League members, has made several public addresses on the subject. He outlined a proposed scheme for the construction of a dam two miles from Sunnyside on the Waiau river and some 20 miles above Clifden. He believed that there was a large catchment area ready to be tapped.

PERSONALITIES

IN THE INDUSTRY

From the North-Western Division comes the news that **Mr. J. W. Steeley,** A.M.I.E.E., A.M.I.Mech.E., has been appointed station superintendent at Manchester's Stuart Street power station. He succeeds **Mr. J. Whitfield,** who, as announced in our August 9 issue, has been appointed generation engineer (operation) to No. 3 Sub-Division. Mr. Steeley has held the appointment of deputy superintendent at Stuart Street since 1948. Educated at Hymers College, Hull, and the Hull Technical College, Mr. Steeley served in the city's electricity undertaking from 1933 until 1946, in which year he became shift engineer-in-charge at Stuart Street. He remained there until March, 1947, when he obtained the post of assistant station superintendent with the I.C.I. (general chemicals division) at their Weston Point power station, Runcorn. In January, 1948, he was promoted to resident engineer at the Pilkington-Sullivan power station, Widnes, and held this post until he returned to Manchester in November of the same year.

Mr. J. W. Steeley

The new president of the Illuminating Engineering Society, **Mr. J. G. Holmes,** B.Sc., A.R.C.S., F.Inst.P., F.I.E.S., whose presidential address is reported elsewhere in this issue, is a glass and lighting technologist, becoming interested in both subjects in his student days at London University. He was with Chance Bros. for a number of years and joined Holophane Ltd., at the end of the war. He is the first centre chairman of the I.E.S. to become president, and has been a member of the Council for several years. His activities in connection with a number of committees and societies, include the chairmanship of the N.I.C. sub-committee on light signal colours, that of the Physical Society's Colour Group and the London section of the Society of Glass Technology. He was awarded the Leon Gaster Memorial premium in 1941.

Mr. J. D. Rutherford, who has been appointed chief contract engineer at the works of Bailey Meters, Ltd., London, is a native of Berwick. Trained in electrical and mechanical engineering, after obtaining an engineering degree, he was with Clarke Chapman and Co., and the North-Eastern Electric Supply Co., Ltd., before joining Bailey Meters, Ltd., eight years ago.

The Radio Industry representatives on the Radio Rearmament Advisory Committee are: **Mr. A. G. Clark** (Plessey Co., Ltd.), **Mr. L. T. Hinton** (Standard Telephones and Cables, Ltd.), **Mr. M. M. McQueen** (General Electric Co., Ltd.), **Mr. F. S. Mockford** (Marconi's Wireless Telegraph Co., Ltd.), **Mr. E. J. Power** (Murphy Radio, Ltd.), **Mr. J. W. Ridgeway** (Edison Swan Electric Co., Ltd.), **Mr. E. E. Rosen** (Ultra Electric, Ltd.), and **Mr. C. O. Stanley** (Pye, Ltd.).

The decision to appoint the committee was announced by Mr. Strauss in the House of Commons on July 23, when he said that the main purpose of the committee would be to enable the Ministry of Supply to discuss defence matters with the radio industry. The committee recently held its first meeting under the chairmanship of the Minister.

Mr. Michael Schofield has resigned his position as sales manager to the Denis Ferranti Co. Ltd., and has taken up the appointment of Middle East manager to the British Overseas Engineering and Construction Corporation Ltd. He will be based in Cyprus and will cover Middle East territories from there.

Mr. Michael Schofield

We understand that the British Overseas Engineering and Construction Corporation Ltd. will act as agents for the Denis Ferranti Co. Ltd. in several countries, so Mr. Schofield will not be completely severing his connection with that company.

Following the annual general meeting of the British Valve Manufacturers' Association last week, the Executive Committee elected as chairman of the Association, **Mr. N. P. Newman,** J.P., managing director of Newman, Hender & Co., Ltd. Mr. Newman succeeds **Mr. E. Bruce Bail,** managing director of Glenfield & Kennedy, Ltd., who has held the chairmanship for three years.

This year's recipient of the Leon Gaster Memorial premium is **Mr. H. W Cumming,** B.Sc., A.R.I.C., of the Preston research laboratories of Siemens Electric Lamps and Supplies Ltd. The Leon Gaster premium is awarded annually by the Illuminating Engineering Society for the best contribution submitted during the year. Mr. Cumming's paper, "The Extension of the Gas Arc Condition," was reviewed in our issue of Feb. 22 this year, upon the occasion of its presentation.

Mr. T. B. Parker, chief rubber cable technologist to Johnson and Phillips Ltd., has been presented with a suitably inscribed silver cigarette box in appreciation of his 50 years' service with the company. At 65 Mr. Parker is one of the leading rubber technologists in the cable industry. For very many years he has played an important part in the preparation of the basic C.M.A. specifications, and still serves on a number of C.M.A. technical committees. He has also given considerable assistance to Service departments—particularly the Admiralty—in cable design and has a wide experience in the development of mining type cables.

Mr. T. B. Parker

Mr. Parker joined J. and P. in September, 1901, and served in the old arc lamp department for five years, after which time he transferred to the cable department. In 1935 he took control of the technical construction and design of rubber cables in the J. and P. laboratories.

Mr. J. M. Drummond, A.S.A.A.(HONS.), F.I.M.T.A., has been appointed a deputy chief accountant of the British Electricity Authority. Mr. Drummond has been city treasurer of Sheffield since Sept., 1948, and was, from 1945, deputy city treasurer at Sheffield. Previously, he was borough treasurer at Darlington. Mr. Drummond has been in local authority service since 1921.

Mr. F. A. Lovett, superintendent of insulation, varnish, enamel and resin factories to the British Thomson-Houston Co. Ltd., who was awarded the British Empire Medal in a recent Honours List, has just received his medal at the hands of Lord Willoughby de Broke, M.C., A.F.C., who, in his capacity of Lord-Lieutenant of Warwickshire, deputised for His Majesty. The presentation was made at Rugby Works in the presence of civic authorities and a number of colleagues and B.T.H. directors, including Mr. W. W. Vinsen (director of manufacture), Mr. H. L. Satchell (director and manager Rugby works), Mr. K. R. Hopkirk (chief mechanical engineer) and Mr. E. S. Little (comptroller and secretary).

Mr. W. B. Robson, A.M.I.E.E., has relinquished his position as head of publicity and order departments with Brookhirst Switchgear Ltd., Chester, upon his appointment as general manager of Cantie Switches Ltd., Bromborough, Cheshire. Mr. Robson has his early training at Reyrolle and Co., Ltd., Hebburn, and, following appointments with the English Electric Co., Ltd., and Electroflo Meters Co., Ltd., he joined Brookhirst Switchgear Ltd. in 1938. Between 1939 and 1946, he held the positions of personal assistant to the managing directors, manager of branch works, and subsequently assistant works manager.

Mr. W. B. Robson

London Transport announces that **Mr. A. C. Newby,** formerly planning engineer at Charlton works, has been appointed assistant works manager (trams and trolleybuses) in the department of the chief mechanical engineer (road services).

Mr. Newby, who is 58, served an indentured apprenticeship with the L.C.C. Tramways at Charlton works and progressed through the grades of inspector and draughtsman to become a technical assistant in 1934. From 1941 until 1945, he was responsible for production and war work at Charlton works and in the latter year was appointed production engineer. He became planning engineer in 1947.

At the recent Llandudno conference of the Purchasing Officers Association the following were elected for the year 1951-2: *President,* **Mr. T. L. Garner,** M.SC., D.L.C., A.R.I.C., A.M.I.CHEM.E., A.F.R.AE.SOC., F.I.R.I. (Precision Rubbers Ltd.). *Vice-presidents:* **P. C. Corrance** (Blackburn (Dumbarton) Ltd.); **A. Elliott** (The Churchill Machine Tool Co., Ltd.); **J. C. Thompson** (Edgar Allen and Co., Ltd.); **C. H. Tomlinson** (Boots Pure Drug Co., Ltd.); **H. H. C. Wood** (Igranic Electric Co., Ltd.); and **D. Wragg** (Thos. Firth and John Brown Ltd.). *Chairman:* **Mr. H. W. King** (Eburite Corrugated Containers Ltd.). *Vice-chairman:* **Mr. F. J. White** (Chance Bros. Ltd.). *Hon. Treasurer:* **Mr. R. J. Mitchell** (The Morgan Crucible Co., Ltd.).

Mr. F. A. Lovett receives the British Empire Medal L. to R. Mr. D. E. Biart (Town Clerk of Rugby), Councillor L. B. Fox (Mayor of Rugby), Lord Willoughby de Broke, Mr. F. A. Lovett, Mr. W. W. Vinsen (Director of Manufacture, B.T.H.), Mr. S. A. Davis (Regional Controller, M.O.S.)

The Minister of Fuel and Power has appointed **Mr. William Parsons**, of Tadcaster, Yorkshire, as an additional member of the Yorkshire Electricity Consultative Council.

Miss Rosemary Garland, formerly with Chance Bros., Ltd., has now been appointed publicity officer to the Glass Manufacturers Federation and can be contacted at 17 Manchester St., W.1.

A presentation has been made to **Mr. William Davies** on his retirement after 36 years' service, with Whipp and Bourne Ltd. Mr. Allan Clark presided, and Mr. H. Coar, on behalf of the directors and staff, made the presentation.

Major-General L. B. Nicholls, C.B., C.B.E., M.I.E.E., chairman of Cable and Wireless Ltd. left on Tuesday in the *Mauretania* for a three-weeks visit to the U.S., where he will confer with chiefs of the American overseas telegraph services. He plans to return by way of Canada where he will meet executives of Canadian Overseas Telecommunications Dept. and Canadian Marconi.

OBITUARY

The sudden death of **Mr. C. T. S. Arnett,** O.B.E., B.SC., M.I.E.E., M.INST.F., late controller of the N.W. Division, B.E.A., so soon after his retirement, will come as a shock to many. The announcement of his retirement appeared in this journal last week.

The British Driver-Harris Co., Ltd., of Manchester, deeply regret to announce the death of **Mr. S. C. Leoni,** who was connected with the Driver-Harris organisation for nearly twenty years, and was latterly director of both the Italian and French companies.

The London Electricity Board regrets to announce the deaths of two senior officials: **Mr. H. W. Cox,** sub-area accountant (Western Sub-Area), and **Mr. W. H. Flear,** property manager (secretary's department), both of whom died on Sept. 27. Mr. Cox was formerly accountant of the Brompton and Kensington Electricity Supply Co., Ltd., and Mr. Flear was secretary of the Chelsea Electricity Supply Co., Ltd. On the formation of Central London Electricity Ltd., by amalgamation of those companies and others, Mr. Cox became an assistant accountant of the company and Mr. Flear properties manager.

The death has occurred at Sunderland, at the age of 73, of **Major Sir Robert N. Thompson,** a well-known Wearside shipbuilder, and a director of the Sunderland Forge and Engineering Co., Ltd., and John Lynn and Co., Ltd.

The death is reported from Holland of **Dr. Anton Frederick Philips,** president of the board of Philips Electrical Industries, Eindhoven. He was 77 years of age, and had devoted 55 years of his life to the building-up of the Philips organisation.

The British Vacuum Cleaner and Engineering Co., Ltd., announce the death of **Mr. F. W. Lawlor,** district manager of the Norwich branch of Goblin Electric Appliances, Ltd. He had been with the company since 1927.

Wills.—Mr. John Flew, of Cottingham, Yorks, chairman of the Crystal Motor General and Electrical Engineering Co., Ltd., who died on Jan. 21 last, aged 43 years, left £26,754. (£11,741 net).

Mr. Henry William Headland, electrical dealer of Southend-on-Sea, and of Leyton, E.10, who died on May 16 last, aged 67 years, left £5,419 12s. 9d. (£5,242 16s. net value).

Electric Vehicles in the U.S.

WHILE the battery vehicle flourishes for industrial purposes in the United States, its use for delivery purposes is steadily declining. According to a market report issued by the Board of Trade and prepared by the commercial department of the British Embassy in Washington, the manufacture of delivery vehicles has not been carried out for 20 years and, although there are a few vehicles in service in the New York and New Orleans areas, they are from 25-30 years old and will not be replaced when worn out.

Reasons given for the obsolescence of the electric vehicle include the extension of areas served by tradesmen and the frequent recharging necessitated, which renders battery vehicles uneconomical; also the tendency for the comparatively slower battery vehicle to create hold-ups in modern, fast-moving traffic. These reasons are reinforced by an abundant and cheap supply of petrol.

The industrial truck, however, is a very different proposition. The total number of electric trucks in use in the U.S. at December, 1950, is estimated at 44,000, with a further 21,000 of the pedestrian controlled or "driver-walk" type. Seventy per cent. of the industrial trucks are stated to be of the fork-lift type. Production figures for the year 1947 (taken from the census of manufactures) are as follows: electric and petrol-electric fork trucks, 3,522; petrol fork trucks, 14,421; non-fork electric and petrol-electric, 1,300; non-fork petrol driven, 1,142. Powered trucks (not segregated), pedestrian controlled, were given as 7,469.

The demand for industrial trucks is stated to be constant, without seasonal fluctuations. Fork trucks of up to 4,000 lb capacity are popular, although in certain areas (notably New Orleans) the demand is for larger trucks up to 6,000-8,000 lb. Petrol-driven trucks are normally more popular owing to the lower first cost.

Present supplies are stated to be in excess of demand and competition is keen. There are no import restrictions or government regulations, but there are import duties up to 12½%, and 20% on replacement batteries. It is felt that U.K. vehicles would have to possess very distinct technical advantages to gain a footing.

The BUYER'S *Column*

G.E.C. Lighting Carbons

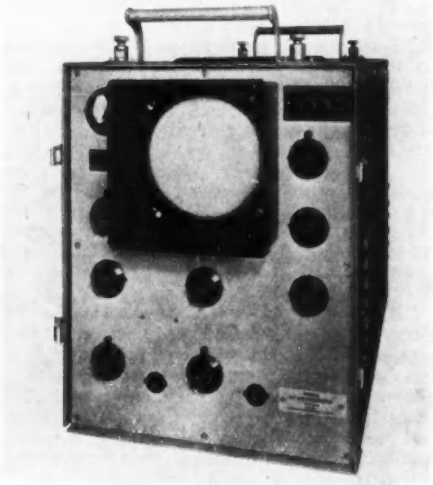
THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has announced that it will discontinue the manufacture and sale of lighting carbons at the end of this year, when the factory concerned will change over to the manufacture of other types of carbon products.

S.T.C. introduce H.F. Spectrometer

THE high-frequency spectrometer, manufactured by STANDARD TELEPHONES AND CABLES LTD., Connaught House, Aldwych W.C.2, made its debut during the war years. It was not until after the war that it became widely known as a complex waveform analyser with an exceptionally high resolving speed, capable of analysing the whole of the frequency spectrum between 6·4 kc/s and 4 mc/s.

The latest model of the instrument employs a 6-in. cathode ray tube, on the screen of which a visual indication is given of both the frequency and the amplitude of the components of a complex waveform. The display on the screen is arranged as a number of vertical lines; the frequency of each component being indicated by its horizontal position while the amplitude is directly proportional to the length of line traced. Permanent records can be obtained by the use of either still or cine cameras.

The instrument operates from 220/240 V, 40-60 c/s, a.c. supplies, and an auto-transformer available enables it to be used on other voltages.

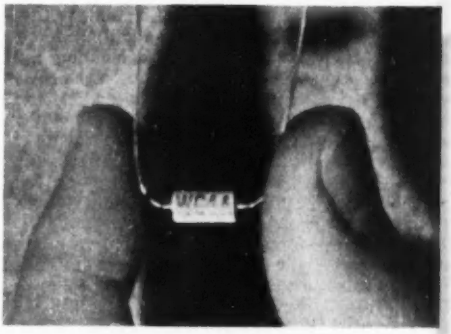


The standard High Frequency Spectrometer

Germanium Crystal Rectifiers

A WIDE range of germanium crystal rectifiers has been introduced by WESTINGHOUSE BRAKE AND SIGNAL CO., LTD., 82 York Way, London N.1. These are of hermetically sealed ceramic construction and are one half inch long by three sixteenths inch diameter. The range of types covers peak working voltages up to 100 V and forward currents of 50 MA.

These crystal rectifiers are suitable for detectors,



A Westinghouse Germanium Crystal Rectifier held between the forefinger and thumb

limiters, instruments and general purposes, the self capacity of all types being approximately 1 pF.

Each crystal rectifier is mounted on a colour-coded card giving the rating particulars. A leaflet, M.R.14, supplement 5, is available showing typical characteristics of all types and includes a tabulated list showing which type to select for each of the 16 applications, for which these germanium crystal rectifiers are particularly suitable.

Plus Packs extend Juno's Uses

THE introduction by TRUVOX ENGINEERING CO., LTD., of Exhibition Grounds, Wembley, Middx., of "Plus Packs" greatly extends the range of uses to which their "Juno" domestic floor polisher may be put.

For use in conjunction with the "Juno," "B" Plus Pack enables users to "dry-clean" their polished floors. Main feature of this pack is the specially formed steel wire wool pad which clips over the rotary brush. A rubber skirt prevents the dust rising; in this way large floors can be cleaned of accumulated wax and dirt in a short time.

For treating badly scarred floors which need resurfacing, the special sanding discs provided with "A" plus packs are suitable. Again the disc fits over the existing rotary brush (a felt pad is provided to ensure firm grip between brush and

sanding disc and the special rubber skirt is supplied.

Retail prices are 33s. 6d. for the "A" plus pack and 27s. for the "B" pack.

The Collis Stacker Manual/Electric

THE two main designs of the Collis Stacker have up to the present been manual/hydraulic and electric/hydraulic. The latter makes full use of electric power where available to speed up the operation of stacking with employment of less manual effort. Several companies, however, fully equipped with power, find the need for a stacking machine to perform the two functions of stacking internally with the use of power, and loading and unloading vehicles some distance away where no power is available. The engineers of J. COLLIS AND SONS LTD., Regent Square, London W.C.1, applied themselves to this problem and produced the Stacker Manual/Electric. Maintaining the hydraulic principle of operation, this machine is very similar in appearance to the normal electric hydraulic model of the Collis Stacker, but by the introduction of twin control valves and a parallel link motion housed between the wheel forks at the base of the handle, this unit now embodies the full advantages of the two previous designs. There is no complicated selection mechanism whatsoever. The changeover from electric to manual operation or vice-versa is instantaneous, or simultaneous should this be necessary. The usual control lever for raising or lowering the load is fitted, this being common to both manual and electric operations.

The Manual/Electric Stacker combines the advantages of both the hydraulic and electric models

The model featured here has a telescopic head and is fitted with the usual automatic cut-out at the top and bottom of the lift.

TRADE PUBLICATIONS

LADDERS.—A leaflet issued by Lyte Ladders, Ltd., Lyte Works, Ragestone, Monmouthshire, lists the many types of ladders, trestles, tripods, etc., available from the firm.

NICKEL-IRON ALLOYS.—A new publication on the physical properties of the nickel-iron alloys is to hand from the Mond Nickel Co., Ltd., of Sunderland House, Curzon Street, W.1. Extensive data on tensile strength, hardness and electrical resistance, elastic and expansion properties includes a section dealing with applications for temperature control devices such as thermostats, for expansion control in engineering construction and for glass to metal seals, and a comprehensive bibliography.

LATHES.—A leaflet is available which summarises the advantages of the Series 15 lathe marketed by Pultra, Ltd., 24 Gravel Lane, Salford 3, Manchester.

NEW METROVICK PUBLICATIONS.—They have recently issued new publications dealing with the following subjects: Automatic excitation control of large alternators. H.V. transformers in the Netherlands. Three-phase distribution transformers, type TC. Buchholz protectors (two-float pattern). Metalclad switchgear, type SB. Metalclad switchgear, type KOC. Intertripping of remote circuit-breakers. Flameproof switchgear, type SF. D.C. motors, type DK. D.C. machine tool drives, type Q. Multi-speed A.C. commutator motor. Electric suds pump for machine tools. Fractional horsepower motors—types and applications. D.C. motor control panels. Flameproof drum controllers. Cam-operated contactor controllers, type C. A.C. direct-on contactor starters, type DOC. Improved cases for switchboard relays. Controller and reverser, FC 1 4 for battery vehicles. Speed-indicating equipment, type L, for commercial and passenger vehicles. Air-operated window wiper, type 3WP. A.C. vane railway signalling relay, type L8. Rail connectors. Atomic hydrogen arc welding plant. Spot welding machine, type AS. Univick electrode. "Exelvick" electrode. Type EG electrode. "Metrolux" crack detector. Oil condensation pump type O2. Velometers direct reading air velocity meters.

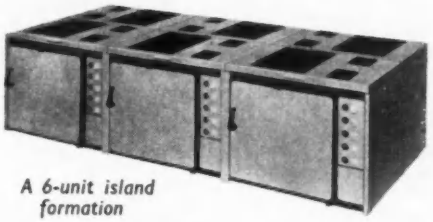
"NIMONIC" ALLOYS.—A new publication by Henry Wiggin and Co., Ltd., Wiggin Street Birmingham 16, tabulates all the available informa-on the "Nimonic" series of nickel-chromium alloys. Physical and mechanical properties and design data at various temperatures, are given, and recent data obtained during long time creep testing is included. The list of typical applications include many at elevated temperatures such as gas turbine blades. The publication also lists the forms in which the various alloys are available.

Creda "Unit" Ranges

WHEN the Creda Unit range for heavy duty cooking was shown in prototype at the Hotel and Catering Exhibition it attracted a considerable amount of interest and many of the suggestions made by experienced caterers have been incorporated in the production model.

Designed for wall or island combinations, the unit is manufactured in 8 and 4½ cu. ft. sizes either of which can be butted together to prevent grease or dirt accumulating between them. Unit

4½ and 8 cu. ft. ranges butted together



A 6-unit island formation

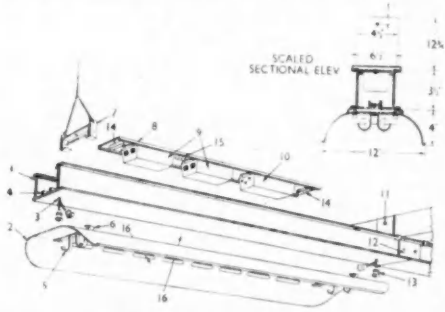
construction also facilitates handling since it eliminates dismantling and re-erection charges while the flexibility obtainable facilitates kitchen planning and maintenance since a single unit can be withdrawn without upsetting the others.

Other points of design worthy of note are the height (2 ft. 10 in.) the provision of adequate space between the boiling plates, the close-fitting oven door, with concealed adjustable ventilator, and two-rate thermostat control to obtain rapid initial heating. The oven loading is 6.4 kW for the 8 cu. ft. and 4.4 kW for the 4½ cu. ft. model. Boiling plates on the smaller unit include two 8 in. by 6 in. rated at 1.25 kW with a large plate 16 in. by 12 in. rated at 4 kW. The large plate on the 8½ cu. ft. unit is double this size, heat being controlled in two sections. Simmerstat control of all plates can be supplied if required.

New Development in Lighting Trunking

THE introduction of vitreous enamelled reflectors to their lighting trunking equipment is a new development recently announced by the General Electric Co., Ltd., and it has recently been applied in a Tyneside textile factory.

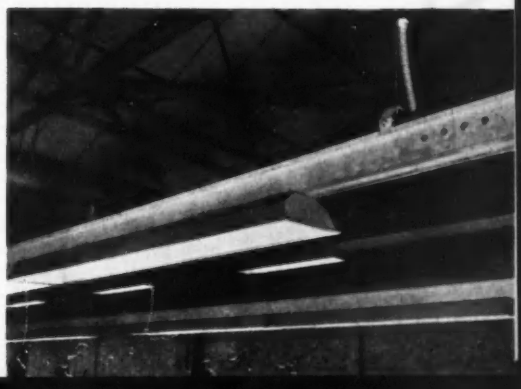
The construction of the trunking itself is shown in the accompanying diagram which is self-explanatory, while a view of the gear with the vitreous enamelled reflector in position is also shown. Adjacent sections of the trunking which is supplied in 15 ft. lengths, are joined by means of fishplates and the complete run is suspended either by girder clips or by rods. The use of this type of suspension enables the mounting height to be varied to suit the particular conditions and illumination intensity required, the latter being also variable by spacing of the reflectors instead of butting them end to end, and by variation of the number of lamps in each fitting. In the particular installation under consideration, carried out by James Scott and Co., Ltd., of Edinburgh, to the instructions of Messrs. Gregory and Partners, consulting engineers, intensities vary from 10 to 60 lumens per sq. ft.



Exploded view of trunking

1. *Metal trunking.* 2. *Sheet steel reflector.* 3. *Hole for lampholder leads drilled on site.* 4. *Wiring runs.* 5. *Lamp support.* 6. *Reflector supporting strap (slides on to trunking).* 7. *Suspensions bracket (wire or rod suspension).* 8. *Control gear tray.* 9. *Combined choke and instant start units.* 10. *Capacitor.* 11. *Fishplate for attaching trunking to beams.* 12. *Fishplate for joining lengths of trunking.* 13. *B.C. lampholders (Home Office shielded pattern).* 14. *Four-way terminal blocks.* 15. *Two-way terminal block.* 16. *Slots for upward illumination*

Below shows the general appearance of the unit



The Purification of Industrial Gases

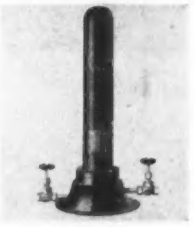
IN many industrial processes a requirement is the supply of gases which are almost entirely free from oxygen. Particular examples of this need may be found in such metallurgical processes as bright annealing, and the manufacture of powder metals and in certain chemical processes such as the synthesis of ammonia.

A recent American process which has been made available in this country by the Baker Platinum Co., representing Baker and Co., Inc., employs the use of precious metals as catalysts in the removal of oxygen from hydrogen, and has many most apparent advantages. Summarised, these are simplicity and compactness of the units, no operating or maintenance expenses, no power supply or auxiliary heating required - the unit operates at room temperature—and therefore no water cooling required. The catalyst, unless it becomes "poisoned," lasts indefinitely.

The Baker "Deoxo" system is extremely simple in operation. After a passage of the gas through the purifier at room temperature less than one part per million of the oxygen remains. The removal of the oxygen is accomplished by passing the gas over a specially prepared catalyst from the platinum group, such as palladium, which brings about a combination of hydrogen and oxygen to form water vapour. This takes place at normal room temperature, the resultant water vapour is carried away in the gas stream and can be removed by any dehydrator.

In view of the nature of the chemical reaction it will be seen that both hydrogen and oxygen can be removed from inert gases such as nitrogen, argon, helium, neon, CO_2 and saturated hydrocarbons provided that the ratio of quantities of each gas present is such that the chemical combination may be effected.

It is intended to offer the "Deoxo" units in the following sizes: 5, 200, 1,000, 2,500 and 5,000 cFh capacities.



These illustrations show the simplicity of the Deoxo Apparatus and the scheme of operations

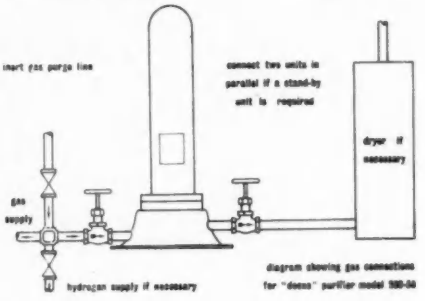

inert gas purge line
connect two units in parallel if a stand-by unit is required
dryer if necessary
gas supply
hydrogen supply if necessary

diagram showing gas connections for "deoxo" purifier model 500-06

RESALE PRICE MAINTENANCE

A STATEMENT issued by the Electrical Fair Trading Council deals with the recent White Paper (Cmd 8274) proposing legislation to prevent the establishment of price maintenance agreements. It is pointed out that the White Paper states that in drafting legislation account will be taken of any cases where it may be established that exceptional conditions "would render the operation of the proposed provisions unworkable or undesirable in the public interest."

It is contended by the Electrical Fair Trading Council, that "exceptional conditions" apply to electrical products and a submission is accordingly being made to the Board of Trade to this effect.

The statement points out that the White Paper alleges that price maintenance enhances the prices of goods to the public and that free and unrestricted competition would be in the public interest. As far as the electrical industry is concerned, these assumptions are incorrect and unwarranted. The electrical industry is relatively modern and it has striven to ensure the quality of its goods by standardisation through the B.S.I. In parallel with its technical progress it has devoted considerable attention to the distribution of goods and to the problem of keeping the price to the public as low as is consistent with good quality. The successful efforts made by the industry in this direction became effective with the formation of the Electrical Fair Trading Council in 1933 and the issue of the Council's policy for the home trade in 1936. As a result of this policy it became possible to introduce a general lowering of distribution discounts thus benefitting to the consumer.

The case for exclusion of the electrical industry is based on the facts that in order to keep in the forefront of development and to bear the costs of research and tooling for production a stable market must be assured. Unstable conditions could easily lead to a rapid deterioration of quality with danger to the user of the equipment.

Distributors required a known fair profit margin if they were to be able to provide the necessary technical services associated with electrical equipment sales and finally the security of all workers in the manufacturing and distributing sections of the industry would be endangered if a price-cutting war were allowed to develop.

The statement concludes by emphasising the fact that none is denied entrance to the electrical industry, and that the Fair Trading policy represents the common assent to a trading structure, continuously worked out by consultation among the various sections of the industry.

THE WEEK

COMMERCE *in news* INDUSTRY

Winter Lighting Restrictions

DESPITE the formality and brevity of Parliamentary proceedings last Thursday sufficient time was found to approve the restrictions imposed on advertisement lighting this winter. The effect of the latest licence made by the Minister of Fuel and Power will be to restrict the use of electricity for shop-window and other advertisement lighting only between the hours of 7 a.m. and 1 p.m. from October 8 to October 19. As from October 22 however, these restrictions will operate between 7 a.m. and 7 p.m., and this arrangement will continue until April 4 next year. As on previous occasions the ban will not apply on Saturdays and Sundays, and it will also be relaxed on December 25 and 26 in England and Wales and on January 1 in Scotland.

It will be recalled that the parent order—Electric Lighting (Restriction) Order 1949—provides that power supplied by an Electricity Board may not be used for advertisement purposes during restricted periods on Mondays to Fridays between the first Saturday in October and the first Saturday in April. There are no restrictions whatsoever on the use of electricity generated by private means.

Commenting on this announcement, the Electrical Sign Manufacturers' Association has said, all doubts that another complete ban on the use of electric signs should now be removed.

The B.E.A. Report

THE third report and statement of accounts of the British Electricity Authority, covering the year ended March 31, 1951, will be published to-morrow (Friday). It will be dealt with fully in our next issue, appearing on October 18.

Extra Allocation to Boards

AT a meeting of the S.E. Scotland Electricity Consultative Council last week, the chairman announced that as a result of strong representations, the Chancellor of the Exchequer had released £2,500,000 among the Area Boards so that electricity could be supplied to new houses. S.E. Scotland's share of this extra allocation would be £150,000, which, the chairman stated, would enable the Board to go ahead with connecting new estates and street lighting schemes, previously held up on the grounds of capital limitation.

The Council was also told that following accountants' report on payments in lieu of rates, the Board was to make a claim on the Central Authority. Payments in respect of installations amounted to £221,000 last year, compared with £124,000 the previous year. As a result of the report, the Board had now to pay £162,000 instead of the £221,000.

Lead Scrap Prices Reduced

A NEW order reducing the price of re-melted lead and lead scrap by £5 per ton, has been made by the Minister of Supply, following the recent decrease in the price of lead. The new prices are £160 per ton for re-melted lead and scrap cable sheathing, and £156 per ton for other lead scrap. The Non-Ferrous Metals Prices (No. 8) Order came into force on Monday and is available at H.M.S.O.

Restrictions on Copper and Zinc

THE Board of Trade has announced a new order extending the prohibitions of manufacture in copper, zinc, brass and other alloys made in February this year, to include some 30 additional domestic articles. The order becomes operative as from next Monday and is the result of the agreement made by member countries of O.E.E.C. which was referred to in these columns last week. The amended list does not, however, include any electrical equipment, though it must be pointed out that the Ministry of Supply has yet to announce the additions to their list of prohibitions.

The B.o.T. has also stated that the Monopolies Commission's report on electric lamps has been received and will be published shortly.

The First Half-Century

A certain amount of further information has been made public as to the proposed electric railway from London to Brighton. Shortly the route chosen starts from a London station in Lupus Street to a terminus in Brighton at the back of Brunswick Square and except at the London end is to run close beside the London and Brighton Company's direct line for nearly all the way. Financially speaking, such a line would seem to have little chance provided the company met the emergency by converting one of its three routes to electric traction, and doing a little new construction work at the London end and at junctions. What the promoters think it will cost them to build an entirely new line, with a London terminus and bridge over the Thames, is yet to be seen.—*From our issue of October 10, 1901.*

A tight squeeze even for the newly developed 500 kVA transformer designed to meet such situations

Power System Calculations

NEWLY announced by the Heriot-Watt College, Edinburgh, is a course of lectures on power system calculations from the steady state, to be held on seven successive Saturday mornings from 9.30 a.m. to 12 noon, beginning on October 20. Subjects discussed will include synchronous machines and transformers, including short-circuit characteristics, transmission lines, networks, symmetrical and asymmetrical short-circuits, and system stability. The four lecturers will be Professors M. G. Say and E. O. Taylor, of the Department of Electrical Engineering, Heriot-Watt College, Mr. F. H. Birch, Technical Engineer, N.E. Division, B.E.A., and Mr. R. K. Edgley, power system research engineer, A. Reyrolle and Co. Fee for the course is two guineas, and further particulars can be obtained from the Secretary, Heriot-Watt College, Chambers Street, Edinburgh 1.

Floodlighting Soccer

SPORTS writers are lauding the potentialities of floodlit football at present, as a result of two matches played in these conditions quite recently. The games were at Southampton and Highbury (Arsenal) between which clubs there seems to be a good deal of rivalry to install the first really efficient system. We note that Simplex Electric Co., Ltd. have played a large part in the venture at Southampton, supplying much of the equipment. This includes 16 Reflecto-flood floodlights, each fitted with 1,500 W lamps. The cost was said to be in the region of £600.

The installation at Highbury was carried out by the club's own electrical staff. It comprises a total of 84 1,000 W projectors, each connected to the circuit via a length of c.t.s. by means of a watertight socket-outlet. There are separate switchboards for the control of floodlighting in the basement of each stand. The v.r.i. cables are run in galvanised conduit, and each switchboard consists of an ironclad main switch and eight ironclad distribution switches.

Need for small Transformers

THE installation of transformers in London sub-stations is in many instances an unenviable task. Some indication of the problem to be faced may be gained from the illustration on this page of English Electric equipment being lowered into a sub-station at (appropriately enough) the headquarters of the I.E.E. in Savoy Hill. To help in overcoming this difficulty the English Electric, at the request of the London Electricity Board, has developed sub-station transformers whose overall size has been reduced to a minimum. They have been designed on the low loss principle for the highest efficiency and are rated at 500 kVA for the metropolitan area.

Priorities for Electricity

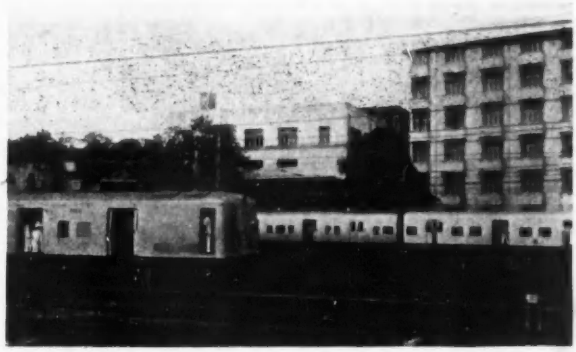
A LOCAL committee of the Eastern Electricity Consultative Council has expressed the view the Board had insufficient information as to the relative priorities of the various schemes now being planned. It was appreciated, however, that the amount of work which could be undertaken was limited by the allocation of capital investment. The committee was considering a number of representations from farmers who require supplies. In reply to applications, the Board has stated that restrictions on capital expenditure prevented them from carrying out all the development work which was wanted.

Electricity and Farms

AN Anglo-American Productivity Team which has returned to this country, was most forcibly impressed by electrical development on U.S. farms. American farmers are giving greater attention to increasing output by the introduction of mechanical devices thus eliminating undue strain and fatigue. Over 200 jobs on the farm can now be done by electrical apparatus and the team urges that electrification of farms in this country should be pressed forward by every possible means. Compared with the 40% of farms in Britain, the team states, electricity is available on over 85% of American farms. This is attributable largely to the work of the Department of Agriculture's Rural Electrification Administration, which makes loans available at a low rate of interest for rural development. A uniform method of charging for extensions of lines requires farmers to guarantee a minimum annual payment, inclusive of electricity consumed, amounting to 12% of the cost.

Falcon's Second Reunion

THE Falcon Association, which constitutes an important link between former apprentices and



Some of the new electric coaches supplied to the Great Indian Peninsula Railway in recent weeks

the Brush Electrical Engineering Co., held its second reunion and annual dinner at Loughborough recently. The Association now has a total membership of some 464, and 160 members and guests travelled from many parts of Britain to this second reunion. The week-end's activities included a tour of the works to learn of developments in the past year, a dinner, rugby match between the Falcons and the present Apprentices Association, and proceedings were completed with a dance on the final evening. Also included in the programme was the annual meeting, at which Mr. J. W. C. Milligan, general manager and local director, was re-elected president.

Iron and Steel Consumers' Council

THE Iron and Steel Consumers' Council, set up by the Minister of Supply during the summer, held its first meeting a short time ago to discuss future procedure. The Council will deal only with matters of general principle and points out that a consumer should, wherever possible, approach his supplier direct with difficulties. On more general matters, such as the allocation scheme for steel which is to be introduced shortly, the consumer should approach his sponsoring department, either direct or through his trade association.

Electric Rolling Stock for India

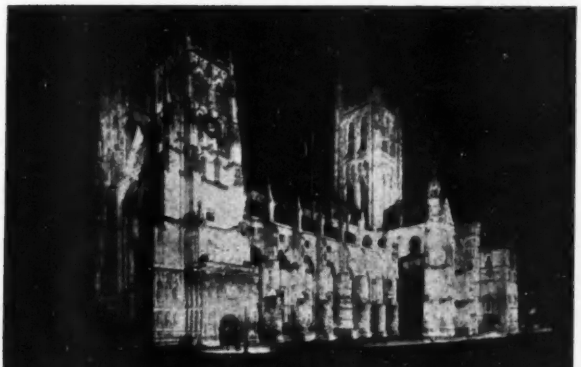
PHOTOGRAPHS reached us last week of the new electric rolling stock now in service on the Great Indian Peninsula Railway. Trains are being operated similarly to those on our own Southern Region, namely, in four-coach units. Each is made up of two 1,500 V motor coaches of 700 h.p. and two non-driving trailer coaches. The maximum service speed is 70 m.p.h., one hour tractive effort is 18,800 lb at 27 m.p.h. and continuous tractive effort, 12,700 lb at 31 m.p.h. Braking is electro-pneumatic. One feature of these trains is the design of equipment to facilitate running through flooded tracks during the monsoon season. The design enables these coaches to run through flood water 8 in. above the rails at speeds up to 5 m.p.h., the traction equipment being waterproofed to a height of 30 in. above the rails. Incidentally, this latest order supplements a large amount of stock, still in service, supplied in 1928. Electrical equipment for all these coaches was supplied by the English Electric Co. and British Thomson-Houston Co.

Radio Warnings not Wanted?

MANY readers will undoubtedly recall the extensive plans laid by the Yorkshire Electricity Board for the transmission of radio warnings announcing impending power cuts. Reports from that area state, however, that only 40 industrial firms have planned to install short-wave radio receivers. The majority of large factories were notified of the scheme some months ago. The system is to operate as from the beginning of next month.

Fire Brigades win Fame

FIRE Brigades, though their importance is irrefutable, are not bodies which receive frequent mention in our pages, but the achievements of two such teams which have come to our notice this week are certainly remarkable. Competing against 31 teams at the annual tournament of the London Private Fire Brigades' Association the works brigade of Micanite and Insulators Co., Ltd. won the Championship of the U.K. and First Division Championship for the second successive year. They



An impressive view of Canterbury Cathedral floodlit by equipment supplied by Simplex Electric Co., Ltd. The same company also supplied fittings for a similar scheme to illuminate St. Augustine's College Gate, in the same city. Both installations were carried out by the South Eastern Electricity Board

Benjamin Anolier lighting fittings used in the installation carried out at Kodak's London showroom in Kingsway

were also awarded the Hitchcock shield for two-man drill and Achille Serre cup for five-man drill.

No less illustrious is W. T. Glover's brigade in Manchester, who number among their trophies the Hydraulic cup presented by the Chester County Fire Brigade, and the Harrison shield given by the British Fire Association. The first mentioned was won in the face of competition from 51 professional teams.

A Dignified Installation

THE dignified appearance of Kodak's London showroom has been maintained as a result of the new lighting installation which comprises Benjamin type 55 Anolier fittings. The units have a well-diffused light without shadow or glare and the brightness of the fittings does not compete with the many showcase displays. The Anoliers themselves, which would not be out of place in the drawing room, are made of aluminium with Bri-Tal anodised finish. The often repeated problem of finding easy access for cleaning and replacing the lamp has been overcome quite easily as the bottom cup is fixed by three legs and can be removed simply.

E.C.A. Proposal Rejected

SOUTH SHIELDS town council has rejected a proposal by the E.C.A. that electrical fittings should be included in contracts for electrical work. At present the N.E. Electricity Board assists the council in preparing specifications and also supplies all electrical fittings. It has been decided to continue this arrangement, under which the council receives a special discount of 15%. Contractors will be allowed a 5% discount on list prices for fittings supplied by the Corporation.

Sir Edward Crowe, responding to the toast of "The Henley Companies" at the staff dinner and dance of W. T. Henley's Telegraph Works Co. Ltd. With him are Sir Montague Hughman and the Rev. G. H. Salter, Vicar of St. Sepulchre's

Wide Choice of Sales Aids

A BROCHURE made attractive by the illustration and explanation of sundry sales aids, has been made available to dealers by Philips Electrical Ltd. The book reviews the whole range of aids produced by the company for their lamps and lighting advertising campaign for this winter. Among this media is the "Press and Compare" unit for counter displays, which enables the customer to see the difference between the normal pearl and new Argenta silica coated lamp. The hand-with-lamp cut-out will also be useful. It is provided with two pins in the edge of the sleeve so that it can be pressed into the wooden beading of a door or window frame. Amusing cut-outs of a cat and kittens form the highlight of a window display. Infra-red lamp showcards, "Photoflux" flash bulb display cut-outs, and many others are also available as well as catalogues and literature.

Election Tie-up

THE General Election is too good an event for advertisement copymen to miss and one lighting firm at least has tied-up its Press publicity campaign with the occasion. This is Ekco-Ensign whose election candidate, a lamp bedecked with a rosette and striped trousers, urges the populace to "Put me in—I'll brighten up the house." The topical advertisements will be used until October 25 when the company will revert to its more usual aids, already mentioned in these columns.

Death while using Washing Machine

AT a Stoke inquest some days ago, the coroner warned amateurs against tampering with electricity. He said washing machines were completely safe when properly earthed. A verdict of accidental death was recorded on a local woman who was electrocuted while using a washing machine which her husband had "mended." He

said he had taken the plug to pieces and found the earth wire loose. He refixed it and there had been no further trouble. A member of the Midland Electricity Board told the coroner that the plug was not wired properly. The earth insulation was bared and loose at one end, and this had come into contact with one of the "live" points.

Production of Fires to be Cut

ADDRESSING the Combustion Engineering Association on Tuesday, the Minister of Fuel and Power said the production of electric fires would be cut again next year to save power. This type of fire was a danger to the industry, he said, because it was a major cause of power cuts. Steps already taken to curb sales were the imposition of purchase tax and the refusal of Area Boards to display the fires. Production had already been reduced and next year a further reduction would be made to make way for other essential products.

Electricity for Miners

A DISPUTE between the Rossington miners and the Yorkshire Electricity Board, which began about four months ago, has now reached a satisfactory conclusion. Readers may recall that at one time the miners threatened to strike if their houses were not supplied with electricity. The Board, on the other hand, explained that the houses could not be connected to the mains because of a lack of capital. Increased investment allocations granted to the Y.E.B. by the B.E.A. since then however, will permit plans to proceed and a supply of electricity arranged. There are over 1,500 miners' homes involved, but this allocation will probably facilitate connections to all houses in Rossington and Denaby in the near future.

U.S. Industrialists visit B.T.H.

A DELEGATION of American industrialists, headed by Messrs. E. C. Givens and C. V. Schelke, vice-presidents of the International General Electric Co., are visiting this country to see our methods of production, especially in the field of heavy electrical plant. Last week the party spent a full day at British Thomson-Houston's Rugby works where they completed an extensive tour of the turbine, heavy electrical plant, large transformer, rectifier and other factories. They also found time to visit the research laboratory and spend a less arduous period at the company's apprentices' hostel.

Another firm to entertain recently was Elliott Bros. (London), Ltd., whose guests were members of the I.E.E. (Measurements Section), and their ladies, holding their summer visit. The day was spent looking over the research laboratories at Boreham Wood and the Gate Studios at Elstree.

The Council of the Electrical Wholesalers Federation photographed with members of the Scottish section when they met at Turnberry, Ayrshire, last week. Mr. G. W. Cartwright, the president, is in the centre of the group

NEWS IN BRIEF

Philips Electrical Ltd. have opened a new depot for lamps and lighting equipment, including a small showroom, at 21-23 Hope Street, Hanley, Stoke. Telephone number is Stoke 2532.

Due to be published next year is a commercial telephone directory in four languages, English, French, Spanish and German. Applications for entries should be sent to International Telephone Directory, 12 Sackville Street, W.1.

The seventh All-Industry Refrigeration and Air Conditioning Exhibition, sponsored by the Refrigeration Equipment Manufacturers' Association in Washington, will be held in Chicago between November 5 and 8.

Sir John Hallsworth, chairman of the N.W. Electricity Board, opened the second arts and crafts exhibition organised by the N.W. District Joint Advisory Council

A new radio-telephone service between Zanzibar and Mombasa was opened on Monday, Cable and Wireless Ltd. have announced. At Mombasa it has been linked to the public telephone system, but at Zanzibar it is mainly available from the company's office.

Thorn Electrical Industries Ltd., are endeavouring to obtain permission to extend their Merthyr Tydfil factory.

Annual meeting and dinner of the Electrical Wholesalers Federation will take place at the Savoy Hotel, London, on March 20, 1952.

An exhibition entitled "Manpower" and concerned with the human factor in industry is at present open at the Safety Health and Welfare Museum, Horseferry Road, Westminster, London S.W.1, and will remain open until October 19.

A new apprentices training school is to be built by C. A. Parsons and Co. Ltd., Newcastle.

Electric Supply News

Agricultural Districts

An extension of the scale of annual payments of compensation for interference with agricultural operations has been agreed as a result of discussions between the B.E.A., N.F.U. (England and Wales), and Country Landowners' Association. The new scale is to provide for the larger towers which will be erected to support the 275 kV overhead lines. Previously the scale covered payments for towers of 20 ft. sq. Under the new agreement payments are from 9s 6d a year for towers of 10 ft sq. or under on arable land and 2s 6d a year on cultivated grass, to £2 a year for towers of 35 ft sq. or over on arable land and 7s 6d on cultivated grass. Payments for existing towers of 25 ft sq. and over are to be made according to the extended scale.

Barrhead

The S.W. Scotland Electricity Board has approved a scheme to reinforce the network at Barrhead. It involves the laying of an 11kV underground cable and installation of additional equipment in two existing substations and is estimated to cost about £11,000.

Laugharne

The South Wales Electricity Board has had negotiations with Williams Bros. concerning the acquisition of the latter's electricity supply undertaking in the parish. But at the recent parish council meeting, the Board intimated that because of restriction of capital investment they were unable to contemplate taking over the undertaking at present. And although negotiations had been made, they were unable to arrive at mutually acceptable terms.

N.W. Electricity Board

A standard tariff will be introduced in the N.W. area early next year. When the Board took over, more than 700 different tariffs were in operation under municipal and private undertakings. Between now and Christmas notices are to be sent out to industrial, commercial and domestic consumers terminating the present agreements for charges.

Scotland

Increased output from hydro-electric schemes and new plants being brought into operation, generation of electricity in Scotland this winter is expected to be 25% higher than last year. On the other hand consumption has been estimated at 18% more than in 1950. Consequently industry is being asked to reduce consumption by 20% at peak periods for four months this winter instead of six months.

At a meeting in Glasgow last week, Mr. E. J. Edgar, divisional controller for S.W. Scotland, said too rosy a picture had been painted so far as Scotland was concerned but added that they could export southwards, 85,000 kW this winter.

Shropshire

Preliminary work has started on a development scheme covering about 45 sq. miles in West Shropshire, which will ultimately give a supply of electricity to 42 villages and hamlets. The scheme entails the erection of approximately 53 miles of overhead lines and 62 pole-mounted sub-stations and will afford a supply to some 530 premises. The Midlands Electricity Board, announcing that the project has been approved, has stated that the scheme will take about two years to complete.

Swindon

The Town Council is to apply for consent to borrow £12,500 in respect of the cost of part of the generating plant required in connection with a scheme to utilise gas produced by sludge digestion for the generation of electricity, and £57,500 for the remainder of the work necessary. Convinced that early installation of the sludge digestion plant would enable Rodbourne sewage works to be entirely self-supporting for electricity and save between 600 and 800 tons of coal a year, the Sewage Works Committee successfully proposed at last week's meeting of Council that this part of the scheme of modernisation should be brought forward. It is estimated that a saving of nearly £27,000 can be effected in 25 years.

Westmorland

A suggestion by a Manchester scientist involving the installation of underwater cables in Derwentwater and in the River Derwent has been rejected by the N.W. Electricity Board on the grounds that it would cost more than a new scheme prepared for the district to overcome opposition to overhead cables. In regard to dropping a cable in Derwentwater, the Board stated that excavations into the shores would be necessary to bring out tappings as the water was liable to rise 14 ft during storms.

LIGHTING SCHEMES

Birkenhead T.C.—Approval being sought for a loan of £23,770 for street lighting programme during 1951-52.

Colne Valley Y.D.C.—Scheme approved for electrification of street lighting at Golcar, Linthwaite and Marsden at estimated cost of £14,365.

Guildford T.C.—Council recommended to submit for approval scheme for mercury lighting along the by-pass. Estimated cost, £9,700.

March U.D.C.—Street lighting scheme has been approved and council authorised to borrow £4,745.

Peterborough T.C.—Mercury lamps to be installed in six roads at a cost of £4,671. Also schemes are being prepared in respect of three housing estates.

Wigan.—Following complaints regarding lighting on Worsley Hall estate, the borough engineer has been instructed to install relays in 115 of the lights. The Streets Lighting Committee has decided to convert all 60 W lamps there to 100 W.

Company Activities

Aeronautical and General Instruments

Group trading profit for the year is £48,168 as compared with a trading loss of £7,654 for the previous year. After depreciation of £5,034 (*nil*) and other charges the profit was £36,562 (—*£14,438*). Taxation reserves of £1,673 (*£4,111*) not required, tax recoverable of £2,200 (*£8,000*), profit on the sale of land nil (*£48,812*), plus £19,621 (*£23,579*) brought in makes available £60,056 (*£85,302* before deducting loss). Profits tax takes £1,368 (*£955*) and reserve for future tax is £5,350 (*£1,575*). Special stock provision receives £10,000 (*same*) and general reserves get £10,000 (*£35,000*), leaving £25,611. Group current assets £511,926 (*£495,227*). Current liabilities amount to £104,780 (*£109,172*).

Berrys Electric

Trading profit before charging taxation and depreciation amounted to £113,497 as against £84,464 for last year. Balance sheet shows current assets at £354,150 have been increased by £46,763. Issued share capital is now £190,354.

Brazilian Traction Light and Power

Proposals to split the no-par Ordinary shares and to preserve the rights of the 6% Cumulative Preference shares are to be submitted at meetings to be held in Toronto next month. Ordinary shares will be subdivided on a two for one basis. To preserve the rights of the Preference shareholders they will have eight votes for each share held (four votes at the moment) and can convert three Preference for 20 Ordinary (as compared to 10 at the moment).

Lawley Group

Whitehall Securities Corporation has acquired 132,998 of the 5s. Ordinary shares of the Lawley Group in addition to those previously purchased from the Lawley family.

Mexican Light and Power

Consolidated operating revenue for three months ended June 30, in Canadian Currency is $6,355,339. Operating and other expenses including taxes and depreciation $5,527,964 net operating revenue $807,375. Charges on funded debts and construction loans $487.056. Adjusted net operating revenue for the first quarter is approximately $1,000,000 as compared with $900,000 for second quarter aggregate operating revenue from Jan 1, is $12,527,838 ($*10,822,593*) and net revenue $1,901,441 ($*926,391*) less debt charges of $942,253 ($*830,932*).

Morphy-Richards

For the year to June 30, the profit, after charging taxation, is £96,605 compared with £42,102 for the previous 12 months. Taxation absorbs £133,118 (*£59,487*). The final dividend is 25%, again making 40%. After deducting adjustments of previous years of £7,066 (*£3,294*) and minority interests £14,319 (*£5,075*), the net profit is £75,220 (*£33,733*).

Palestine Electric Corporation

The directors have announced that approximately £18,000 is available to the credit of the sinking fund for the 4½% redeemable Cumulative Preference stock and that they are prepared to receive tenders of stock for redemption.

Peto Scott

Group net profit for the 15 months to June 30 last, is £8,046 against a loss of £8,558 for the preceding year after taxation of £14,232 (*credit £496*) Tax reserve is allocated £9,500 (*nil*) leaving a carry forward of £16,156 (*£20,655*). It is proposed to increase the capital to £90,000 and make a bonus issue of one new share for each share held.

Scottish Cables (S. Africa) Ltd.

Trading profit for the year amounts to £173,005. Directors' fees and depreciation takes £22,526, leaving a profit of £100,479, less provision for taxation £27,550, leaves £72,929 for appropriation. Preliminary expenses £5,509, proposed dividend of 5% £30,000 and allocation to general reserve of £30,000 leaves £7,420 carried forward.

Stotter and Pitt

A final dividend of 5% and a bonus of 1¼% both less tax are recommended. This makes a total of 11¼% for the year on the £400,000 ordinary as increased last year by a scrip bonus of 33⅓.

Results for the year 1950-1951 shows profit at £216,383 (*£233,738*) amount to re-equipment reserve £50,000 (*same*). To contingency account nil (*£50,000*) to dividend equalisation nil (*£20,000*) The revenue reserve takes £73,211 (*£50,000*) and pensions funds £40,000 (*nil*). Employees bonus this year totals £25,000 against £20,000. Off capital including expenses is £1,732 (*nil*) leaving 86,550 (*£86,379*) carried forward.

Vatric

A consolidated trading surplus of £302,658 for the year to March 31 against £156,346 against the previous year is reported. Net profit before tax is £243,149 (*£80,340*). Taxation takes £68,712 (*£9,106*), £48,000 (*nil*) is transferred to loans repayment reserve, leaving a carry forward of £97,260 against a debit of £29,177 brought in.

Dividends Declared

Ericsson Telephones.—Interim dividend of 5% tax free (*same*).

Marconi Marine. An interim dividend of 4% payable November 27, against 2½% last year. Total for last year is 10%.

Rawplug.—Interim dividend 10% (*same*) last years total was 50%.

Skefko.—Interim dividend of 5% tax free (*same*)

Commercial Information

CONTRACTS OPEN

HOME

Oct. 12.—Belfast. Electrical installation in gymnasium and lecture rooms at Stranmillis Training College. Ministry of Finance, Room 103, Law Court Bldgs., May St.

Oct. 13.—Turriff T.C. Electrical work in building of 10 houses on Church St. site. A. Simpson, Town Clerk, Municipal Bldgs.

Oct. 15.—Darlington R.D.C. Two electric motor and centrifugal pumping sets, one of 4,500 gal./hr and one of 12,000 gal./hr. Apply to Consulting Engineer, A. Brooksbank, 14 The Exchange, Bradford. Deposit £2 2s.

Oct. 15.—Lancashire. Complete electrical installation in police houses erected in the county. About 100 such houses are built each year. Applications by above date to G. Noel-Hill, County Architect, County Hall, Preston.

Oct. 15.—Newton Abbot U.D.C. Electrical work in erection of 42 houses on Buckland estate, comprising Contract 19. Surveyor, 18 Devon Sq.

Oct. 15.—Sunderland T.C. Electrical installation in 802 houses on Hylton Red House and Pennywell estates. Borough Architect, Grange House, Stockton Rd. Deposit £2 2s.

Oct. 16.—Burghead T.C. Electrical work in erection of 10 houses in King St. and Granary St. J. and W. Wittet, Architects, 81 High St., Elgin.

Oct. 17.—Edinburgh. Installation of 230 V power wiring at Deanbank, Canaan Lane. City Architect's Office, City Chambers.

Oct. 17.—Leyton. Conversion of tower hoist at High Rd. baths from manual to electrical operation. Superintendent, Public Baths Dept., High Rd., E.10. (See Sept. 27 issue.)

Oct. 17.—Torquay T.C. Electrical installation for new Beach Dept.'s store under public library. Applications to Borough Surveyor, Town Hall. Deposit £2 2s.

Oct. 20.—Sutherland. Electrical work in erection of additional accommodation at Dornoch Academy. County Architect is E. W. Brannen, Carnegie Bldgs., Dornoch.

Oct. 22.—Feeny (Co. Derry). Installation of electrical heating in Presbyterian Church at Feeny. S. G. M. Craig, Esq., Drumcoritt House, Feeny, Derry.

Oct. 22.—Romford. Lighting is included among works in Tennyson Rd. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.

Oct. 29.—Exeter T.C. Supply of switchgear for Pynes waterworks. John Brierley, City Engineer, Surveyor and Water Engineer, Municipal Offices, 7 Southernhay West, Exeter.

Oct. 31.—Brighton T.C. Dismantling the existing passenger lift and installing a new one at the Town Hall. Borough Engineer and Surveyor, 26-30 King's Rd., Brighton.

Nov. 9.—Bingley U.D.C. Tenders invited for (*a*) supply, erection and installation of 18 concrete lighting columns, lanterns and auxiliary equipment in Mornington Rd., and (*b*) erection and conversion of gas lighting columns and supply, erection and installation of 17 swan-neck brackets, lanterns and auxiliary equipment in Chapel Lane and Dubb Lane. J. S. Lattin, Engineer and Surveyor, Town Hall. Deposit £2 2s. in respect of each scheme. (See Oct. 4 issue.)

No date stated.—North of Scotland H.E. Board. Supply, delivery and erection of 11 kV and lower voltage wood pole lines in the north-east of Aberdeenshire, Strichen area. Work divided into three contracts. Apply to Merz and McLellan, Consulting Engineers, 39 Northumberland St., Edinburgh 3. Deposit £1 1s. for each contract. (See Sept. 20 issue.)

No date stated.—Oswaldtwistle U.D.C. Installation and erection of 50 400 W and 25 135 W h.p. m.v. columns and brackets for 1951-52 lighting scheme. T. D. Manning, Engineer and Surveyor, Town Hall, Oswaldtwistle. (See Sept. 20 issue.)

No date stated.—N. of Scotland H.E. Board. Electrical installations at Errochty power station, Perthshire, covering lighting, heating and auxiliary cabling. Engineers are Merz and McLellan, 39 Northumberland St., Edinburgh 3. Deposit £2 2s. (See Sept. 27 issue.)

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

Oct. 29.—India. Supply of two motor-driven boring lathes with standard electrical equipment for 400/440 V, 3-phase, 50 c/s, a.c. supply, for Director General of Supplies and Disposals.

Oct. 30.—Egypt. Dismantling of existing d.c. generating set, supply and erection of new d.c. set 400 b.h.p., complete with all accessories; also fuel oil storage tank with electric motor-pump, at Chebin el Kom power station. Municipalities Administration, Ministry of Municipal and Rural Affairs, Cairo. B.o.T. (Ref. CRE (IB) 71922/51).*

Nov. 1.—India. Supply of high-speed steel salt bath hardening furnace of electrode immersion type for operation on 400/440 V, 3-phase, 50 c/s, a.c. supply. Director General of Supplies and Disposals, Shahjahan Rd., New Delhi. B.o.T. (Ref. CRE (IB) 72133/51).*

Nov. 6.—New Zealand. Supply of 500 miles of cadmium-copper wire 1/·050 in., polyvinyl chloride insulated. Each conductor must be covered with general purpose p.v.c. insulant. G.P.O., Wellington. B.o.T. (Ref. CRE (IB) 71971/51).*

Nov. 7.—India. Director General of Supplies and Disposals, Shahjahan Rd., New Delhi, invites tenders for hand-operated flash welding machine complete with transformer rated 25 kVA at 50% duty cycles. Provided for single-phase connection to 400 V, a.c. supply.

Nov. 19.—Uruguay. Usinas Electricas y Los Telefonos del Estado invite tenders for large quantity of electricity meters. They are required for a.c., single-phase and 3-phase destined for 3-wire distribution network without neutral. B.o.T. (Ref. CRE (IB) 71950/51).*

Nov. 27.—New Zealand. Supply of 500 MVA 11 kV duplicate busbar indoor metal-clad draw-out type switchgear for Islington substation. State Hydro-Electric Dept., Wellington. Documents available at N.Z. Govt. Offices in London. Deposit £100.

Nov. 28.—Australia. State Electricity Commission of Victoria, 22-32 William St., Melbourne, invites tenders for control equipment for 1,100 V d.c. locomotives.

Nov. 28.—India. One electromagnetic crack-detecting apparatus for testing of railway axles for Director-General of Supplies and Disposals. B.o.T. (Ref. CRE (IB) 71267/51).*

Nov. 30.—India. Supply of one 7,500 kW set and two 40/50,000 lb per hour boilers with auxiliary equipment for Utran power house. Chief Engineer, Electric Grid Offices, Mercantile Bank Building, Bombay. B.o.T. (Ref. CRE (IB) 72063/51).*

Dec. 1.—France. Construction of machines for stripping and extraction of lignite for Beylongue deposit. Lignite is to feed 100,000 kW plant. Electricite de France, Region d'Equipment Thermique 1, 5 Avenue du Coq, Paris. (Advertised in this issue.)

Dec. 12.—Queensland. Supply of small distribution type transformers suitable for outdoor service in tropical conditions, for State Electricity Commission, Scottish Union House, Eagle St., Brisbane. B.o.T. (Ref. CRE (IB) 71931/51).*

Dec. 14.—Brisbane. Manufacture and supply of one turbo-alternator set of 30 MW continuous rating, or two sets of this rating, complete with all accessories for City Council, City Hall. B.o.T. (Ref. CRE (IB) 70974/51).*

Jan. 11, 1952.—Brisbane. Supply of six 5,000 kVA, 3-phase, 50 p.p.s., 33 kV delta to 11,000/6,350 V star, step-down, outdoor type distribution transformers for City Council B.o.T. (Ref. CRE (IB) 71898/51).*

No date stated.—Nigeria. Tenders invited for supply of electric cookers, kettles, water heaters (12 and 50 galls.), ceiling fans, table fans, and refrigerators. Details from E. C. Inston, Electricity Corp. of Nigeria, The Corner House, Gt. Peter St., S.W.1. (See Oct. 4 issue.)

CONTRACTS PLACED

Atherstone R.D.C. Street lighting on Ansley Common, Revo Electric Co., £946.

B.E.A. High-pressure pipework and valves, Babcock and Wilcox Ltd. and auxiliary switchgear and accessories A. Reyrolle and Co. Ltd., at Meaford "B" station; Generator transformers, C. A. Parsons and Co. Ltd., and auxiliary switchgear, A Reyrolle and Co. Ltd., at Connah's Quay; 3,300 volt auxiliary switchgear and accessories at Chadderton, English Electric Co. Ltd.; 132 kV 2,500 MVA Switchgear, at Goldington, A. Reyrolle and Co. Ltd.; 132 kV 2,500 MVA switchgear at Three Bridges substation, English Electric Co. Ltd.; and 132 kV 3,500 MVA Stitchgear, at Stella South, Blavdon-on-Tyne, A. Reyrolle and Co. Ltd.

Chester T.C. Electrical installation at Blacon infants' school, Merseyside and N. Wales Electricity Board, £4,059.

Lurgan T.C. Electrical installation in 117 houses in Shankil estate, Robt. Stevenson, £2,279.

Newcastle-under-Lyme R.D.C. Rewiring of houses on sites at Meg Acre and Halmerend and Wareton and Alsagers Bank, Newcastle Electrical Co., £2,055.

Northampton T.C. Supply, erection and wiring of 94 street lighting units on Sunnyside estate, E. Midlands Electricity Board, £1,574.

Berwick T.C. Supply and erection of 22 steel columns with lanterns for lighting of Royal Tweed Bridge, General Electric Co., Ltd.

Preston T.C. Electrical installation at Royal Infirmary for Manchester Regional Hospital Board, N.W. Electricity Board, £2,880.

Sheffield T.C. Electrical installation in 822 dwellings on Basegreen estate, Hobson and Scott Ltd., £17,360.

South Shields T.C. Electric rewiring of Barnes county junior school, Watson-Norie, Ltd., £1,510; same at Westoe county secondary school, R. Ramsay and Son, £2,550.

Sunderland. Electrical work at Ryhope General Hospital for Newcastle Regional Hospital Board, F. Reid, Ferens and Co., Ltd., £4,570.

Your Queries — Answered

"R. and G." fluid level controller, makers of? I.C.—Light Production Co., Ltd., 12 Lower Grosvenor Place, S.W.1. (21596)

"Reliance" sterilisers, makers of? H.A.—Rosebery Metal Works Co., 149-153 Rosebery Ave., E.C.1. (21609)

"Hobby" floor polishers, makers of? S.E.—A.E.G. Electric Co., Ltd., 131 Victoria St., Westminster, S.W.1. (21614)

"Synchromains" clocks, makers of? N.W.—Synchronome Co., Ltd., Abbey Works, Mt. Pleasant, Alperton, Middx. (21627)

"Zephyr" fans, makers of? B.F.—Veritys Ltd., Plume Works, Aston, Birmingham. (21638)

"Essco" billiard table irons, makers of? S.W.—J. and J. Siddons Ltd., Hill Top, West Bromwich. (21647)

"Kinderman" photoglazing machines, address for service? S.W.—Try R. F. Hunter Ltd., 51 Gray's Inn Rd., W.C.1. (21659)

"Mayfair" washing machine, agents for? I.S.B.—Metalcraft Mfg. Co. (Canada) Ltd., 72 Newman St., W.1. (21665)

The above are selected from questions we have answered this week. If you have a query, send it to us.

TRADE NOTES

Change of Address. Astor Boisselier and Lawrence Ltd. are moving to larger premises at 9 Savoy St., Strand, W.C.2, as from Monday next. Tel. numbers remain unchanged: Temple Bar 5927 and 6942.

Telephone. Middlesbrough office of British Insulated Callender's Cables Ltd. has additional tel. number. Numbers are now Middlesbrough 2838 and 43569.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	227 0 0	£220 0 0
LEAD, good soft pig (foreign)	175 0 0	152 0 0
" " " " "English" quality	176 10 0	
Tin (99-99.75%) ... . (Cash)	1012½-1017½	—
" (3 months)	948-949	—
ALUMINIUM, commercial purity (del.)	124 0 0	—
ZINC	190 0 0	156 0 0
ARMOURING:		
Galv. Steel Wire (0.104 in.)	55 5 0	—
Mild Steel Tape (0.04 in.)	32 5 0	—

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London, W.C.2.

Aberdon Ltd., 51-51a Cleveland St., W.1. Mechanical, electrical, constructional and general engineers, etc. Cap.: £1,000. Permt. dir.: H. G. Parkinson.

Carosan Ltd., Gascol House, Durham Rd., Bristol 2. Hydraulic, air conditioning, sound and refrigeration engineers, plumbers, etc. Cap.: £1,000. Permt. dirs.: T. J. Clarke and A. H. Clarke.

Caslip Ltd., 9 Cavendish Sq., W.1. Manufacturers and repairers of and dealers in electrical, electronic, atomic, radio and mechanical equipment, etc. Cap.: £100. Dir.: V. A. D. Kent.

Clark Brothers (Morecambe) Ltd., 196 Euston Rd., Morecambe and Heysham. Electrical radio, television and refrigeration engineers, etc. Cap.: £2,000. Permt. gov. dirs.: C. R. Clark and L. G. Clark.

Crawford SouthWestern Manufacturing and Trading Co., Ltd., 47 Crimicar Lane, Sheffield. Manufacturers of and dealers in goods of all kinds, including aluminium and other metal goods, electrical supplies, etc. Cap.: £100. Dirs.: M. S. C. Coveney and Mrs. D. J. Coveney, and H. O. Crawford.

Harding and Hartley Ltd., 3 London Rd., Bedford. Auto electrical and general engineers, etc. Cap.: £2,000. Permt. dirs.: S. R. Harding, J. H. Hartley.

G. and D. Littlewood Contractors Ltd., 1 Regent Place, Birmingham. Electrical, radio, civil and general engineers, etc. Cap.: £100. Dirs.: G. Littlewood and D. Littlewood.

Mutual Benefit Electrical Co. Ltd. Electrical engineers, etc. Cap.: £500. Dir.: R. J. Benney, 73 Snowdon Rd., Fishponds, Bristol.

Northwold Refrigeration Co. Ltd., 13-14 St. Andrew's House, Holborn Cir., E.C.1. Cap.: £100. Dirs.: N. Sanson and R. C. J. Sanson.

Perfex Accessories Ltd. Designers, patentees and mnfrs. of elec., radio, motor and genl. engineering appliances, etc. Cap.: £100. Permt. dirs.: A. Summersby, 7 Chapel Rd., Warlingham, Surrey; and P. Moseley, 70 Morden Way, Sutton, Surrey.

Ray and Breeze Electrical Co. Ltd., 73 Snow Hill, Birmingham. Radio, television, telephonic and telegraphic engineers, etc. Cap.: £4,000. Dirs.: C. G. Breeze and Edith M. Read.

Spenser Electric Co. Ltd. Cap.: £500. Dirs.: D. B. Williams, E. H. Cousens, E. M. Foulkes. Subs.: H. C. Cousins, 139, Welford Rd., Shirley, Warwick., and A. J. Corbett, 35 Woodlands Rd., Birmingham 11.

T. K. Richardson and Co. Ltd. 66 Aigburth Rd., Liverpool 17. To take over the business of an electrical contractor and engineer carried on at Liverpool by T. K. Richardson. Cap.: £2,000. Dirs.: T. K. Richardson (permt. mang. dir.) and P. R. Richardson.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Kamba Electric Ltd. Meeting of members will be held at 20-21 Lawrence Lane, Cheapside, E.C.2, on Nov. 5 at 11 a.m. to receive liquidator's report.

Partnership Dissolved

Robert Berry and Walter Regan electrical engineers trading as "A.B. Electrical Engineering Co." Partnership dissolved as from Jan. 31. Debts received and paid by Robert Berry who will continue business under same name.

BANKRUPTCY ACTS

Intended Dividends

Birkenhead. Wadham E. Holloway, electrical contractor, trading as "Dominion Electric Heating Co." at 23 Market St., Birkenhead. Last day for receiving proofs, Oct. 30. Trustee is Robert Cushing Johnston, 59 Hamilton Sq., Birkenhead.

Brighton. Reginald Davidson, electrical illuminating engineer, trading at 199 High St., Lewes. Last day for receiving proofs, Oct. 24. Trustees is John S. Bradley-Hole, 7 Old Steine, Brighton.

Manchester. Bernard Goldenberg, trading as "B. Goldie and Co.," dealer in electrical goods at 49 Deansgate, Manchester. Last day for receiving proofs, Oct. 19. Trustee is F. C. Ormrod, Official Receiver, 20 Byrom St., Manchester 3.

Luton. Electrical and Car Services (Luton), Ltd., 144 Old Bedford Rd. Last day for receiving proofs, Oct. 17. Liquidator is Alfred G. A. Hayman, 66 Alma St., Luton.

Dividends

London. Leslie Oliver Richardson, electrical engineer trading at 205 Railton Rd., Herne Hill. First and final dividends of 7d. in £ payable on Oct. 31 at Bankruptcy Buildings, Carey St., W.C.2.

Adjourned Public Examination

Manchester. Glynn Clifford Higgins, electrical contractor trading at 45 High St., Sandbach, Cheshire. Date fixed for proceeding with the examination which is to be held at the Court House, Quay St., Manchester 3, is Nov. 16. Time 10.30 a.m.

BUSINESS PROSPECTS

HOME

Airdrie. Dean of Guild Court approved alterations (costing £15,000) to premises of Godfrey Phillips Ltd., Glasgow 1.

Alton (Hants) R.D.C. Construction of 20 dwellings on Faringdon site. Engineer, Council Offices, Barton End, Alton.

Bacup. Scheme approved for first stage in Rossendale College of Further Education.

Bangor (Down). Erection of technical school at Castle Park approved.

Bath. Council recommended to approve the overhaul of electrical installation at Guildhall. Estimated cost is £2,499.

Bathavon R.D.C. Construction of 42 dwellings in five blocks at Bathford. Council's Architect, H. H. Goldsmith, 18 Gay St., Bath.

Birkenhead. Application to be made to borrow £87,702 for construction of Prenton primary school.

Brackley (Northants) R.D.C. Approval granted for erection of 12 houses at Middleton Cheney, 10 at Sulgrave, 8 at Eydon and 6 at Culworth.

Bristol. Erection of primary school on Hartcliffe estate. J. Nelson Meredith, City Architect, Eagle House, Colston Av.

Bury. Pathology laboratory to be built at General Hospital costing £55,800.

Camberwell. Construction of 24 dwellings in Hanover Park and 16 in Naylor Rd. Borough Engineer and Surveyor, Town Hall, Peckham Rd., S.E.5.

Chesterfield R.D.C. Plans in hand to convert 186 houses from gas to electrical installation.

Croydon. Next year's schools programme includes building, alterations and reconstruction of seven schools. Also erection of 42 houses off Gravel Hill for New British Garden Estates Ltd. and 12 maisonettes in Central Hill for Wates Ltd.

Deal T.C. A hundred houses to be built at North Deal.

Dodsworth U.D.C. Erection of 64 houses on two sites. L. Willoughby, Council's Housing Officer, Council Offices, Dodsworth, near Barnsley.

Dorset. Approval granted for erection of fire stations at Hamworthy, Lyme Regis and Beaminster.

Dukinfield T.C. Erection of 36 houses on Yew Tree Lane site. Ernest Barlow, Town Clerk, Town Hall.

Dun Laoghaire T.C. Erection of 116 houses at McCormick's Field. Housing and Town Planning Architect, Harbour House.

Gt. Yarmouth. Junior and infants' school to be built on Magdalen College estate.

Hambledon R.D.C. Construction of 18 houses at Dunsfold and 22 dwellings at Cranleigh Village estate. Engineer and Surveyor, Council Offices, Bury Fields, Guildford.

Hampstead. Tenders expected to be invited shortly for erection of 89 flats and 74 maisonettes in five blocks in Broadhurst Gardens.

Kendal T.C. Erection of 34 dwellings on Hall Garth estate. J. Barnfather, Borough Engineer and Surveyor, Municipal Offices, Lowther St.

Lanark. Approval sought for erection of 142 houses at Cambuslang.

Lewisham. Approval sought for scheme to build outpatients' department at Lewisham Hospital. Estimated cost £184,000. Also it is proposed to develop Dartmouth Rd. site by erection of 21 flats, Westwood Hill site by 70 flats and 20 houses and Shorndean St. site by 8 flats and 7 houses.

Macclesfield. John Morris Ltd., Johnson St., Stockport, have received permission to build a factory on the new industrial estate at Hurdsfield.

Merton and Morden U.D.C. Erection of 54 flats in four blocks in Grand Drive. Harry May, Clerk of the Council, Morden Hall, S.W.19.

Middlesbrough. Erection of admission hospital and outpatients' clinic at St. Luke's Hospital. Chief architect is P. H. Knighton.

Montgomery. County Offices, Welshpool, to be extended at estimated cost of £41,000.

Newcastle-on-Tyne. A new college of technology to be built costing some £718,000. First stage to be undertaken next year. Also Cairns and Byles, 21 Ellison Place, have been appointed electrical consultants for proposed Rutherford grammar school.

Application made for sanction to borrow £155,000 for erection of Denton Sq. primary school. C. S. Errington, 46 Grainger St., is the architect.

North Riding. Erection of county primary school at Loftus. Secretary for Education is F. Barraclough, County Hall, Northallerton.

Norfolk. Schools programme includes building and alterations to six schools in the county.

Nuneaton T.C. Plans submitted for approval of 116 houses on Camp Hill estate, 218 houses and 14 bungalows on Marston estate, 38 houses on Heath End estate and 3 houses in Keebley Cres. It is proposed to build 27 flats on Mount St. site. Also plans are in hand for extensions to factory of Mordun (Engineering) Ltd.

Preston T.C. Proposed erection of 144 flats on Larches estate. Borough Surveyor, Municipal Bldg.

Rawtenstall T.C. Construction of 26 houses on Lomas Lane estate and 18 on Staghills estate. Borough Surveyor, Town Hall.

Rochdale T.C. Erection of 20 flats and 6 houses in Gale St. W. H. G. Mercer, Borough Surveyor, Town Hall.

Scunthorpe T.C. Erection approved of new secondary modern school at cost of £203,281. Plans by County Architect.

Stoke Newington. E. C. Harris and Partners, 3 Bedford Sq., W.C.1, are quantity surveyors for construction of 54 flats on Manor Rd. site.

Tynemouth T.C. Tenders to be invited for erection of 300 houses at Chirton Grange. Borough Engineer, 16 Northumberland Sq., North Shields.

York. Application to be made for sanction to borrow £135,000 for erection of secondary school at Acomb.

OVERSEAS

Holland. Molijn's Industrie en Handelsondernening, Madoerastraat 9, The Hague, wish to receive offers from U.K. manufacturers who can supply 120,000 metres of aluminium h.t. cable with steel-wire core, 6 x 2·9 mm aluminium, 1 x 2·9 mm steel wire, for early shipment to Indonesia.

MEETINGS TO NOTE

THURSDAY, OCT. 11

I.E.S. (Glasgow Centre).—"Lighting for Prevention of Industrial Accidents." E. W. Murray. 39 Elmbank Cres., 6.30 p.m.

I.E.S. (Manchester Centre.)—Annual luncheon. Also presidential address by J. G. Holmes. Town Hall Extension, 6 p.m.

INCORP. PLANT ENGRS. (Kent Branch).—"Thermal Insulation in Buildings." Queen's Head, Maidstone, 7.30 p.m.

ELEC. POWER ENGRS. ASSOC. (Merseyside Tech. Group).—"Television." P. N. Vaughan-Jones and K. B. Pointin. Electricity Showroom, Whitechapel, Liverpool, 7 p.m.

I.E.E. (London).—Inaugural address by President, Sir John Hacking. Savoy Place, 5.30 p.m.

I.E.E. (N.E. Scotland Sub-Centre).—Chairman's address by J. I. Moir. Royal Hotel, Union St., Dundee, 7 p.m.

I.E.E. (W. Wales Sub-Centre).—Chairman's address by G. R. T. Edwards. Plaza Cinema, Swansea, 6 p.m.

FRIDAY, OCT. 12

I.E.S. (Birmingham Centre).—Chairman's address by R. A. Lovell. Imperial Hotel, Temple St., 6 p.m.

A.S.E.E. (Bristol Branch).—"Energy from the Atom." A. F. Possnett. Grand Hotel, 7.30 p.m.

A.S.E.E. (Nottingham Branch).—"Relays and Remote Control." Dr. Ing W. L. Stern. Electricity Showrooms, Smithy Row, 7.30 p.m.

E.I.B.A. (Gloucester Branch).—Annual Ball at Bell Hotel, Gloucester.

E.I.B.A. (N. Staffs Branch).—Buffet Dance at Ash Hall Hotel, Stoke-on-Trent.

E.I.B.A. (Birmingham Branch).—Annual Carnival Dance at G.E.C. Magnet Club, Witton.

I.E.E. (N.E. Students' Section).—"Development of Power Cables." G. P. Cundall. King's College, Newcastle, 6.30 p.m.

I.E.E. (N.E. Students' Section).—"Development of Power Cables." G. P. Cundall. Cleveland Inst., Corporation Rd., Middlesbrough, 6.30 p.m.

MONDAY, OCT. 15

I.E.E. (London Students' Section).—Chairman's address, "Keeping Electricity Safe." K. C. Pounds. Savoy Place, 7 p.m.

BIRMINGHAM ELECTRIC CLUB.—"Equipment of a Television Studio." F. C. McLean. Grand Hotel, 6.15 p.m.

ELEC. POWER ENGRS. ASSOC.—"Simple Outline of Factors Influencing the Stable Operation of Electric Power System." A. H. Gray. Caxton Hall, S.W.1, 7 p.m.

PURCH. OFFICERS' ASSOC. (E. London Branch).—"Study of Prices and Sources of Information." R. J. Mitchell. Valentine Hotel, Perth Rd., Ilford, 7 p.m.

I.E.E. (Mersey and N. Wales Centre).—"Switchgear for Station Auxiliaries." W. A. Snodgrass. Liverpool Royal Instn., Colquith St., 6.30 p.m.

I.E.E. (N.E. Radio and Measurements Group).—Chairman's address by W. W. Campbell. King's College, Newcastle, 6.15 p.m.

I.E.E. (Reading).—"Relation between American Universities and Industry." P. Dunsheath. George Hotel, King St., 7 p.m.

TUESDAY, OCT. 16

A.S.E.E. (London National).—Presidential address by T. G. N. Haldane. L.S.B., Savoy Hill, W.C.2, 6.30 p.m.

ENGRNG. INDUSTRIES ASSOC.—Fourth London Regional Display at New Royal Horticultural Hall, for two days.

INST. OF BRITISH AGRIC. ENGRS.—Presidential address by F. W. Rowland of G.E.C. I.E.E., Savoy Place, 2.30 p.m.

INST. OF FUEL.—Melchett lecture, "Combustion Processes in Engines." Prof. F. H. Gainer. Inst. of Mech. Engrs., Storey's Gate, S.W.1, 5.30 p.m.

I.E.E. (London Discussion Circle).—"The 'j' Operator Method of Calculation," opened by A. W. Gillies. Savoy Place, 6 p.m.

I.E.E. (Cambridge Radio Group).—Chairman's address by G. C. Greenwood. Place not known. 6 p.m.

I.E.E. (N. Midland Utilisation Group).—"Modern Developments in Electric Welding." H. G. Taylor. L.S.B., Aire St., Leeds, 6.30 p.m.

I.E.E. (N.W. Measurements Group).—"Performance Limits in Electrical Instruments." A. H. M. Arnold. Also, "Accuracy of Measurements of Electrical Standards." A. Felton. Engrs. Club, Albert Sq., Manchester, 6.15 p.m.

WEDNESDAY, OCT. 17

I.E.S. (Tees-side Group).—"Lighting in the Home." Miss M. D. Wardlaw. Cleveland Scientific.

INTERNATIONAL MOTOR EXHIBITION.—Opens at Earls Court and continues until Oct. 27.

PURCH. OFFICERS ASSOC. (Slough Branch).—"Purchasing and Progress Procedure." Reindeer Hotel, 7.15 p.m.

I.E.E. (London Radio Section).—Chairman's address by D. C. Espley. Savoy Place, 5.30 p.m.

I.E.E. (N. Midland Centre).—Chairman's address by E. C. Walton. District meeting at Y.E.B., Ferensway, Hull, 7.30 p.m.

I.E.E. (Sheffield Sub-Centre).—Chairman's address by J. E. Pegg. Grand Hotel, 6.30 p.m.

I.E.E. (Scottish Centre).—Chairman's address by Percy Butler. Heriot-Watt College, Edinburgh, 7 p.m.

I.E.E. (Rugby Sub-Centre).—"Construction of Staythorpe Power Station." K. D. Snedden. College of Technology and Arts, 6.30 p.m.

I.E.E. (Southern Centre).—"Protection of Electrical Power Systems." H. Leyburn and C. H. W. Lackey. Tech. College, Brighton, 6.30 p.m.

A.S.E.E. (Coventry Branch).—"Supervisory Remote Control Equipment." Technical College, 7.15 p.m.

A.S.E.E. (Manchester Branch).—"An Armchair Talk." F. J. Pearce. Engineers' Club, Albert Sq., 7.30 p.m.

THURSDAY, OCT. 18

I.E.S. (Gloucester and Cheltenham Centre).—Annual dinner at G.E.C., St. Aldgate St., Gloucester, 6.15 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (Birmingham Branch) "Pimlico District Heating Scheme." A. E. Margolis. Imperial Hotel, 6.30 p.m.

WORCESTER ELECTRIC CLUB.—"Electric Lamps." F. Jamieson. Talbot Hotel, Tything, 7.15 p.m.

I.E.E. (E. Midland Centre).—"Phas-/Neutral System of Supply for h.v. Distribution." G. T. Garwood and G. J. Websdale. District meeting at Corn Exchange, Spalding, 7 p.m.

I.E.E. (S.W. Sub-Centre).—Chairman's address by S. C. Monk. Grand Hotel, Plymouth, 3 p.m.

I.E.E. (Irish Branch).—Chairman's address by B. O'Mougain. Trinity College, Dublin, 6 p.m.

FRIDAY, OCT. 19

A.S.E.E. (Crewe Branch).—"A.C. Motors and Control Gear." F. T. Bartho. Copeland Arms Hotel, Glebe St., Stoke, 7.30 p.m.

MANCHESTER ASSOC. OF ENGRS.—"Electrical Power Distribution in Factories." E. Jacks. Engrs. Club, Albert Sq., 6.45 p.m.

BIRMINGHAM ELEC. CLUB.—1951 Ladies' Evening at Grand Hotel, 7 p.m.

I.E.S. (Huddersfield Group).—"Light Colour and the Stage." E. E. Faraday. Tech. College, Queen St. South, 7.15 p.m.

I.E.E. (N. Staffs Sub-Centre).—"Application of Gas-Turbine Technique to Steam Power." J. F. Field, Midlands Elec. Board, Stoke-on-Trent, 7 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Ardente, with design. 698,103. Class 9. Sound amplifying and reproduction apparatus, etc. R. H. Dent, Ltd., 309 Oxford St., London, W.1.

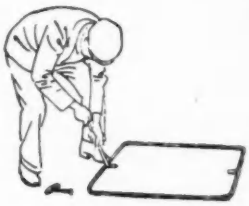
Diadem, with design. 699,598. Class 9. Electrodes for electric welding. Cooper and Turner, Ltd., Vulcan Works, Vulcan Rd., Sheffield 9.

Lascom. 700,175. Class 9. Combined radio and navigation apparatus, signalling equipment, etc. Land, Air and Sea Instrument Co., Ltd., 14 Southampton Place, Bloomsbury, W.C.1.

Lecometic. 697,576. Class 11. Units comprising an electric motor and compressor, for use in refrigerators. Longford Eng. Co., Ltd., Shripney Works, Bognor Regis.

Note these features

The unique features embodied in the construction of the ' Holborn ' Frame and Cover have ensured its popularity amongst users all over the world.



1. **THE COVER SLIDES** easily into and out of the Frame.
2. **ROUNDED CORNERS** give added strength to resist breakage in transit and handling. Fig. 1.
3. **EASY TO REMOVE**—The inclined section prevents dirt and foreign matter wedging the joint. Fig. 2.
4. **NON-SLIP.** Narrow raised serrated edges, scarcely noticed in made-up pathway, minimise slipping by pedestrians.
5. **CORRECT POSITIONING** of cover in frame is ensured by special combined location and pinch bar slot.
6. **TESTS FOR STRENGTH.** Larger size pavement frames and covers were proven in successful weight tests of over 3 tons dead load and half a ton rolling load.
7. **NAME PLATES** available. Loose cast iron plates avoid the necessity of specially cast covers.
8. **WIDE RANGE OF SIZES** to meet all normal requirements.

FIG. 1

FIG. 2

Ask for Catalogue 28

HENLEY

"HOLBORN" PAVEMENT FRAMES AND COVERS

(Covers are supplied without concrete filling.)

W. T. HENLEY'S TELEGRAPH WORKS COMPANY LTD.
51-53 HATTON GARDEN
LONDON, E.C1.

WESTON
Electrical Measuring Instruments

No. 2 Sub-standard Instruments

The Weston Series of Portable sub-standard instruments covers a wide range of applications, including precision measurements in the laboratory . . . meter standardisation . . . transfer standards between D.C and A.C circuits . . . field measurements, acceptance tests, etc. They are available as Wattmeters, Voltmeters, Ammeters and Milliammeters in a variety of ranges and all embody 6" scales, magnetic shielding and spring-loaded jewels. Full details of these instruments, also Weston switchboard, panel, first grade and laboratory standard instruments will gladly be supplied on request.

SANGAMO WESTON LIMITED

Enfield, Middlesex. Tel: Enfield 3434 (6 lines) & 1242 (4 lines). Grams: Sanwest, Enfield

Branches: Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton & Brighton

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. 0d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

ELECTRICITE DE FRANCE

ELECTRICITE DE FRANCE invites TENDERS for the CONSTRUCTION of ADEQUATE MACHINES for the stripping and extraction of the lignite from the Beylongue deposit, lying about 110 km. (68.350 miles) southwards of Bordeaux. This lignite is intended to feed a 100,000 kW power plant, needing 1,350,000 tons of lignite yearly. The deposit thickness varies from 5 to 23 ft. It lies under a layer of deads, whose thickness varies from 23 to 115 ft. Considering the low bearing strength of the land, the prospecting and extraction machines must be set up on the lignite layer, whose bearing strength is about 21.33 lb. per sq. in.

A booklet giving more complete information concerning the principal conditions of the work and the admission conditions for tendering can be obtained from Electricite De France, Region d'Equipement Thermique 1, No. 5 Rue du Coq, Paris (9e), France.

The tenders based on the specification laid down in the above mentioned booklet ought to be completed before December 1, 1951. (N 66)

APPOINTMENTS VACANT

MIDLANDS ELECTRICITY BOARD

Shropshire and Herefordshire Sub-Area

APPOINTMENT OF SECOND ASSISTANT ENGINEER (CIVIL ENGINEERING)

APPLICATIONS are invited for the above position at the Shropshire and Herefordshire Sub-Area Headquarters, Spring Gardens, Ditherington, Shrewsbury.

Applicants should have received a recognised training and have had experience in the preparation of estimates, preliminary plans and working drawings for building projects. They should also be experienced in the administration of contracts and negotiations with contractors. Experience in the design, specification and bills of quantities for buildings of medium size will be an advantage.

Applicants should preferably hold recognised technical qualifications.

Conditions of service will be in accordance with the National Joint Board Agreement, and the salary will be Class "G," Grade 7, £651 per annum.

Applications, stating age, experience and present salary, should be forwarded within 14 days to Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary.

September 27, 1951. (N 76)

CIVIL SERVICE COMMISSION, DUBLIN

POSITIONS VACANT

ASSISTANT ENGINEERS (10) in the Department of Posts and Telegraphs. Salary scales (approx.): Man, £483-£890; Woman, £483-£708 (higher initial salary in certain circumstances). Age limits: 21 to 35 with extensions of the upper limit in certain cases. Applications are invited from persons who fulfil the requirements of the Regulations and (a) hold a recognised University Degree in Engineering (which must include a technical electrical engineering subject) or in science subjects (which must include Experimental Physics) or (b) have passed or have been exempted from the examination leading to Graduate Membership of the Institution of Electrical Engineers. Regulations and further particulars may be obtained from the Secretary, 45, Upper O'Connell Street, Dublin. Latest time for accepting completed application forms: 5 p.m. on November 22, 1951.

(N 95)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable positions:—

ASSISTANT SHIFT CHARGE ENGINEERS—Bankside Generating Station.

Candidates should have a sound technical training up to Higher National Certificate standard, with experience in the running and efficient operation of power station plant.

Salary and conditions in accordance with N.J.B. Schedule, Class "F," Grade 9, plus London Allowance, equal to £616 7s. per annum.

STATION SHIFT CONTROL ENGINEER—Barnes Generating Station.

Candidates should have had a good general education, and technical training up to Higher National Certificate standard preferred.

Previous experience in the operation and control of E.H.T. switchgear is essential.

Salary and conditions in accordance with N.J.B. Schedule, Class "C," Grade 10, plus London Allowance, equal to £507 per annum.

OPERATING ENGINEER—West Ham Generating Station.

Candidates must have had considerable experience in the operation of a modern generating station.

The person appointed will be responsible for the efficiency of the generating station plant, including coal and ash handling.

Character and ability to deal with staff problems are important.

Salary and conditions for this position, which is subject to confirmation by the N.J.B., will be in accordance with the revised N.J.B. Schedule, "Class G," Grade 5, plus London Allowance, equal to £846 6s. per annum.

JUNIOR ENGINEER (DRAWING OFFICE)—Grove Road Generating Station.

Candidates should have received a sound technical training with some subsequent drawing office experience, and have obtained the Ordinary or Higher National Certificate in Mechanical Engineering.

Salary and conditions in accordance with the N.J.B. Schedule, Class "F," Grade 14, plus London Allowance, equal to £456 per annum.

ASSISTANT SHIFT CHARGE ENGINEER—Islington Generating Station.

Candidates should have a sound technical training and have experience in the running and efficient operation of power station plant.

Salary and conditions in accordance with the N.J.B. Schedule, Class "D," Grade 9, plus London Allowance, equal to £568 1s. per annum.

Applications for the foregoing, stating age, experience and qualifications, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, S.W.1, and be received within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(N 101)

SOUTH WALES ELECTRICITY BOARD

AN ENGINEERING DRAUGHTSMAN is required in the Western Sub-Area of the Board at Tenby.

Candidates should have had a sound engineering training, and in particular, experience in the design and layout of substations up to 33 kV.

The position is superannuable and the salary will be in accordance with Schedule D, Grade 6 (£413-£547) of the N.J.B. Agreement.

Applications, stating age, present position and salary, qualifications and experience and giving three referees, to be addressed to the Secretary (Establishments), South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than October 20, 1951.

D. G. DODDS,
Secretary.
(N 97)

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

SECOND AND THIRD ASSISTANT ENGINEERS (ELECTRICAL), GENERAL (CONSTRUCTION) DEPARTMENT

APPLICATIONS are invited from suitably qualified persons for appointments as Second and Third Assistant Engineers (Electrical) in the Generation (Construction) Department.

Applicants should have had works and drawing office experience in the design and preparation of schemes for switchgear, electrical auxiliaries, main and multicore cable work, lighting and heating of large power stations.

The appointment will be subject to the provisions of the Authority's superannuation scheme and to conditions of service as determined by the National Joint Board. Salaries will be in accordance with the National Joint Board Agreement, Schedule "C".

(a) Second Assistant Engineer, Grade 2, Class "AX/DX," £752 to £966 p.a.
(b) Third Assistant Engineer, Grade 5, Class "AX/DX," £579 to £776 p.a.

Forms of application may be obtained from the Divisional Secretary British Electricity Authority, Yorkshire Division, British Electricity House, St. Mary's Road, Leeds 7, to whom completed forms should be returned not later than 14 days after the appearance of this advertisement. Envelopes to be endorsed "Assistant Engineers (Electrical)."

G. A. VOWLES,
Divisional Controller.
(N 75)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the technical (electrical) department at Divisional Sub-Headquarters, West Farm Place, Cockfosters:

GENERAL ASSISTANT ENGINEERS (General Section). Salary in accordance with the N.J.B. Agreement, Schedule "C," Grade 8, Class "AX," £437-569 per annum plus London weighting.

The commencing salary will depend upon qualifications and experience.

The duties of the post will be assisting with the testing and commissioning of electrical plant and maintenance of protective gear in generating stations and sub-stations.

Applicants should preferably be Graduate or Corporate Members of the Institution of Electrical Engineers.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than October 20, 1951. Envelopes should be endorsed: "General Assistant Engineers—General Section."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (N 68)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of INSTRUMENT ENGINEER in the Chief Testing Engineer's Department. The commencing salary for this appointment will be in accordance with Schedule C, Grade 5, of the National Joint Board Agreement, in the range of £629 to £765 p.a. dependent upon qualifications and experience, and will ultimately rise to £810 per annum.

The successful applicant will be responsible for the efficient maintenance of all types of instruments associated with boilers and turbines, other than purely electrical instruments used in connection with electrical energy produced or consumed, at Hams Hall "A" and "B" and Nechells "A" and "B" Generating Stations. In particular, candidates must have had experience in the operation and maintenance of "Multelec" Superheat Controllers, Conductivity Recorders, Dissolved Oxygen Recorders and Bailey Furnace Draught Controllers.

The possession of the Higher National Certificate in Electrical or Mechanical Engineering, or an equivalent qualification, will be considered an advantage.

Conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Forms of application may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham, 13, and should be returned not later than October 27, 1951.

J. W. LAWTON,
Divisional Controller.
(N 104)

BRITISH ELECTRICITY AUTHORITY

SENIOR AND SECOND ASSISTANT ENGINEERS
TRANSMISSION (CONSTRUCTION) BRANCH
CHIEF ENGINEER'S DEPARTMENT
HEADQUARTERS

APPLICATIONS are invited for appointments as Senior and Second Assistant Engineers in the Co-ordination Sub-Branch and as Senior Assistant Engineer in the Maintenance Sub-Branch of the Transmission (Construction) Branch at Headquarters in London.

Applicants should have engineering and educational qualifications not below those required for Associate Membership of the I.E.E.

Candidates for positions in the Co-ordination Sub-Branch should have experience of the preparation of specifications and of dealing with enquiries and tenders for works relating to 132 kV Transmission, with particular reference to 132 kV and lower voltage switchgear. Practical experience of work on site and the general co-ordination of work on transmission schemes from the inception to ultimate commissioning is desirable. Those appointed will be required to prepare specifications, consider and report on tenders and co-ordinate transmission construction work with the Authority's Divisions and with other Departments at Headquarters.

Applicants for the position in the Maintenance Sub-Branch should have experience on the operation and maintenance of a large transmission system, and be capable of summarising and reporting on returns submitted by Divisions. The successful candidate will be required to collate information on the maintenance of the Authority's primary transmission system, with particular reference to costs, to prepare returns and forecasts on construction expenditure, and to perform general duties in connection with the administration of the Transmission Construction Branch.

The Engineers appointed to both the Co-ordination and Maintenance Sub-Branches will be based at Headquarters in London, but the duties of those in the Co-ordination Sub-Branch will entail visits to Divisions and sites in various parts of the country.

The starting salaries for the appointments, which are superannuable, will be determined according to qualifications and experience, within the following salary scales: Senior Assistant Engineer, £975 to £1,234 p.a., rising to a maximum of £1,353 p.a. including London Allowance; Second Assistant Engineer, £814 to £1,081 p.a., rising to a maximum of £1,184 p.a. including London Allowance.

Application forms may be obtained from Secretary's Office (Establishments), Applications Section, British Electricity House, Great Portland Street, London, W.1, and should be completed and returned to D. Moffat, Director of Establishments, not later than October 27, 1951.

Please quote reference AE/211. (N 102)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

ASSISTANT MAINTENANCE ENGINEER (ELECT) at Croydon "A" Power Station. Applicants should have had suitable technical training and experience in the maintenance of e.h.t. switchgear, motors, alternators and all electrical and auxiliary plant appertaining to a power station. Class "F," Grade 9, £564 18s. p.a.

THIRD ASSISTANT ENGINEER (SAFETY) at Divisional Headquarters. Candidates should have a good knowledge of the Factory Acts and the Authority's Safety Rules. Actual operational experience an advantage. Preference given to those who have attended a Ro.S.P.A. course, Higher National Certificate or equivalent qualification required.

N.J.B. conditions of service for both positions. Salaries quote include 5 per cent London allowance.

Applications on forms obtainable from Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-upon-Thames, to be received by October 23, 1951

(N 74)

BRITISH ELECTRICITY AUTHORITY

ASSISTANT LABOUR RELATIONS OFFICER
(Headquarters)

BRITISH ELECTRICITY AUTHORITY invite applications for the post of an Assistant Labour Relations Officer at their headquarters in London.

Candidates should have an extensive knowledge of the operation and application of the Agreements relating to manual workers engaged in the Electricity Supply Industry and experience in all stages of industrial negotiations.

The appointment, which is superannuable, will be within the provisional salary range of £900—£1,250 per annum, inclusive of London Allowance. Starting salary will be in accordance with qualifications and experience.

Applications, stating present post and salary and giving full particulars of qualifications and experience should be sent to D. Moffat, Director of Establishments, British Electricity House, Great Portland Street, London W.1, to be received not later than October 27, 1951. Please quote reference AE/209. (N 94)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

SHIFT CHARGE ENGINEER

APPLICATIONS are invited for the position at Falkirk Power Station, of Shift Charge Engineer, Class "B," Grade 7, of Schedule A, of the N.J.B. Agreement amended as at July 1, 1951. Commencing salary £539 per annum.

Candidates should preferably have experience of steam electric power plant including detailed working knowledge of the operation of steam turbo-generators, modern boiler plant and of high tension electrical switchgear. Certificated engineers with extensive marine experience would also be considered.

Applicants will be subject to superannuation under the terms and conditions approved by the British Electricity Authority.

Applications, stating age and experience, should be addressed to the Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, Portobello, Midlothian, not later than Saturday, October 20, 1951.

J. F. FIELD,
Divisional Controller.
(N 96)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER
NORTHAMPTON POWER STATION

APPLICATIONS are invited for the appointment of Assistant Shift Charge Engineer at the above Generating Station.

Candidates should have had a sound general and technical education, and be experienced in the operation of modern steam power stations.

Conditions of service and salary will be in accordance with the National Joint Board Agreement, the salary being in Class "F," Grade 9, at present £538 per annum. Extension of plant now in progress will, when commissioned, raise the Station classification.

The appointment will be subject to the provisions of the Authority's Superannuation Scheme.

Applications should be submitted on the official form, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, and should be returned not later than October 31, 1951.

L. F. JEFFREY,
Divisional Controller.
October 3, 1951. (N 98)

BRITISH ELECTRICITY AUTHORITY

South Western Division

ASSISTANT SHIFT CHARGE ENGINEER—
PLYMOUTH "A" GENERATING STATION

APPLICATIONS are invited for the position of Assistant Shift Charge Engineer at Plymouth "A" Generating Station.

Applicants should have good technical qualifications and a sound knowledge of the operation and maintenance of generating plant.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class "F," Grade 9, £538-£560 per annum.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, qualifications, experience, present position and salary, should be addressed to the Divisional Secretary, British Electricity Authority, South-Western Division, British Electricity House, 26 Oakfield Road, Bristol 8, so as to be received not later than October 20, 1951.

R. C. BARRETT,
Divisional Secretary.
October 3, 1951. (N 79)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

SENIOR ASSISTANT ENGINEER (efficiency and plant testing) responsible for the control of the Divisional Operation Department Efficiency and Plant Testing Section. Candidates should be a corporate member of the Institution of Mechanical or Electrical Engineers and be experienced in the operation and testing of all types of power station plant (mainly mechanical), collation and analysis of plant performance and test data. Class "AX," Grade 1, commencing at £884 per annum.

ASSISTANT ENGINEER (operation and efficiency), Littlebrook Power Station. Candidates should preferably possess a university degree in Engineering or Corporate Membership of the Institution of Electrical or Mechanical Engineers. Candidates with Higher National Certificate in Electrical or Mechanical Engineering or who hold an equivalent qualification will be given consideration. The successful applicant will be responsible to the station

(*Continued in next column*)

(*Continued from previous column*)

superintendent for the efficient operation, technical investigations and plant testing of the power station plant. Salary, Class "J," Grade 5, £857 per annum.

N.J.B. Conditions of Service for both positions. Salaries quoted subject to addition of 5% London allowance. Applications on forms obtainable from Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-upon-Thames, to be received not later than October 22, 1951. (N 67)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of FIRST ASSISTANT CONTROL ENGINEER (Shift) in the System Operation Department at Divisional Headquarters, Birmingham. The salary for this appointment will be in accordance with Schedule C, Grade 5, of the National Joint Board Agreement, commencing in the range of £629 to £765 per annum, dependent upon qualifications and experience, and rising ultimately to £858 per annum.

Applicants should be graduate members of the Institution of Electrical Engineers, or hold an equivalent qualification, and should have received a sound practical training in connection with system operation and control. Experience in a generating station will be considered an advantage.

Conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Application should be made on forms which may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than October 27, 1951.

F. W. LAWTON,
Divisional Controller.
(N 103)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

GENERAL ASSISTANT ENGINEER
TRANSMISSION DEPARTMENT

APPLICATIONS are invited for the post of General Assistant Engineer in the Transmission Construction Department at this Divisional Headquarters.

Applicants should have a sound practical and theoretical training and considerable experience in the supervision or carrying out of Civil Works Contracts and will be expected to reside in the vicinity of the contract under supervision.

Salary will be in accordance with Class "AX," Grade 8, of the National Joint Board Agreement (£481-£619 per annum). The post is superannuable within the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned not later than October 31, 1951.

L. F. JEFFREY,
Divisional Controller.
(N 99)

SOUTH EASTERN ELECTRICITY BOARD

Mid-Sussex Sub-Area

ENGINEERING DRAUGHTSMEN

SALARY £413-£547 p.a. under N.J.B. Schedule D, Grade 6. Superannuation will be arranged. Appropriate technical qualifications an advantage. Experience is required in sub-station design and layout up to 33 kV and preparation of working drawings for steelwork and plant associated therewith.

Applications, giving two referees, must reach H. Pryce-Jones, M.Eng., M.I.C.E., M.I.E.E., Mid-Sussex Manager, SEEBoard, Mid-Sussex House, North Road, Brighton, 1, by October 22, 1951.

Purley District

DEMONSTRATOR

Salary of £360 by £20 to £440 p.a. under N.J.C. Agreement, Grade 1 plus London Weighting. Superannuation will be arranged. Applicants must be experienced in demonstrating to consumers in their own homes all types of domestic electrical appliances, and be able to organise and conduct public lectures and demonstrations. Appropriate domestic science or housecraft qualifications an advantage.

Applications on forms, obtainable from J. McAlister, B.Sc., A.M.I.E.E., Purley Manager, SEEBoard, Electric House, High Street, Purley, Surrey, to be returned by October 24, 1951.

A. L. BURNELL,
Secretary.
October, 1951. (N 105)

MIDLANDS ELECTRICITY BOARD

Shropshire and Herefordshire Sub-Area

APPOINTMENT OF SECOND ASSISTANT ENGINEER (PLANNING)

APPLICATIONS are invited for the above position at the Shropshire and Herefordshire Sub-Area Headquarters, Spring Gardens, Ditherington, Shrewsbury.

Applicants should have had experience in all branches of distribution work, with considerable experience in the planning of mains extensions and system reinforcements up to 66 kV. They should also have had experience in the preparation of sub-station layouts and specifications for metal-clad switchgear.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers, or hold equivalent qualifications.

Conditions of service will be in accordance with the National Joint Board Agreement, and the salary will be Class "G," Grade 7, £651 per annum.

Applications, stating age, experience and present salary, should be forwarded within 14 days to Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary.

September 27, 1951 (N 77)

BRITISH ELECTRICITY AUTHORITY

South Western Division

SECOND ASSISTANT ENGINEER—TRANSMISSION DEPARTMENT, DIVISIONAL HEADQUARTERS

APPLICATIONS are invited for the appointment of Second Assistant Engineer in the Transmission Department at Divisional Headquarters, Bristol.

Candidates should be corporate members of the Institution of Electrical Engineers or hold equivalent qualifications and should have specialist experience in the construction and maintenance of High Voltage Sub-stations and Transmission Lines.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Grade 2, Class "AX/CX," £809-£945/£981-£1,000 per annum.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, qualifications, experience, present appointment and salary, should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26 Oakfield Road, Bristol, 8, so as to be received not later than October 22, 1951.

R. C. BARRETT,
Divisional Secretary.

October 5, 1951. (N 100)

TRINIDAD & TOBAGO ELECTRICITY COMMISSION

SHIFT ENGINEERS

APPLICATIONS are invited for the appointments of shift engineers at the Commission's power stations in Trinidad.

The Port of Spain Power Station consists of 15,250 kVA of steam turbo alternators with water tube boilers 425 p.s.i., 740° F. and 7,400 kVA of diesel generating plant. The Penal Power Station will have an initial capacity of 10,000 kVA steam turbine plant, and the two stations will be interconnected through a 66 kV transmission line.

Applicants must not be more than 35 years of age, and have served an apprenticeship in mechanical engineering or a pupilage in a power station and have had subsequent experience in the operation of steam turbine and water tube boilers, experienced in the operation of diesel engines is desirable but not essential. Applicants must be capable of taking charge of a shift in any of the Commission's power stations after a short period in which to become familiar with the plant.

The salary of the appointment is in the scale, $2880 by $120 to $2,880 by $240 to $4,080 per annum (£1—$4.80 B.W.I.) (equivalent to £600 per annum increasing by £25 per annum to £800 per annum with one increment of £50 to £850 per annum), subject to satisfactory service.

Furnished quarters at moderate rentals (when available) or a rent allowance in lieu, are provided under the Commission's Regulations.

Free passages are provided for the officer and family.

An outfit allowance of $288 (£50) will be granted on first appointment not exceeding four persons.

The appointment is subject to an agreement for three years in the first instance, and medical examination by the Commissioner's medical adviser.

The successful candidates will be required to sail in July-August, 1952.

Applications, endorsed "Shift Engineer, Trinidad," stating age, marital status, family, nationality, general and technical education, apprenticeship, appointments held, and full details of power station experience, with references, to be submitted to the undersigned within 21 days from the date of this advertisement.

PREECE, CARDEW & RIDER,
8 and 10, Queen Anne's Gate,
Westminster, S.W.1.
(N 112)

AIR MINISTRY invite applications for non-pensionable appointments as STATION ENGINEERS in the Directorate General of Works at R.A.F. Stations.

The salary rises to a maximum of £563 per annum and starting pay depends upon age, experience and qualifications. Annual increases will be granted for satisfactory service where salary is below the maximum.

Candidates, who should be natural born British subjects, should have suitable practical experience and possess the following qualifications :

(a) Ordinary National Certificate in Electrical Engineering or show that they have reached an equivalent standard of technical education;

(b) have served a recognised apprenticeship in electrical engineering with a firm or establishment of good repute;

(c) have had three years' employment in electrical engineering, preferably on the operation and maintenance of mine, factory or workshop plant and services.

Preference will be given to applicants who subsequent to (b) and (c), have had experience of supervising staff.

The work consists of the installation, operation and maintenance of high or medium voltage electrical distribution systems, electrical installations, steam and hot water heating systems and miscellaneous works plant, tools and equipment.

Applicants should state if in addition to experience on above work, they have had responsibility for the maintenance and operation of Diesel-engined generating plant.

Appointments to locations at or nearest to those specified in applications will be arranged as far as possible.

Applications, stating age, qualifications and all previous appointments (with dates), to be addressed to the Air Ministry Directorate General of Works (W.9), Bush House (S.E. Wing), Strand, W.C.2. (N 69)

A LARGE manufacturing firm in South West Lancashire has the following vacancies in its power line insulator department for JUNIOR ENGINEERS, aged 23-30, of Higher National Certificate standard in Electrical Engineering :

(a) TECHNICAL ASSISTANT on production. Duties will include investigational work into production and development of the product, progress chasing and testing. Successful applicant may be given opening on manufacturing side later.

(b) INTERNAL TECHNICAL SALES ASSISTANT. Previous sales experience in the electrical industry and ability to handle correspondence essential.

Applications should be addressed to Box No. 1083, Electrical Times. (N 8)

A LARGE Electrical Engineering Company require a TRANSFORMER DESIGNER for work in a modern factory. Applicants should have experience of all types of distribution transformers. Excellent working conditions. Five-day week. Wide range of sports and social activities. Pension scheme in operation after qualifying period. There are facilities for housing in the case of successful candidates who are married.—Write, stating present occupation, age, and full particulars of experience, quoting Ref. GBE., to Box No. 1105, Electrical Times. (N 52)

APPLICATIONS are invited for vacancies in the Purchasing Dept. of a large electrical engineering manufacturer in the Midlands: (1) SENIOR EXECUTIVE BUYER with first class experience of bulk buying of all classes of relevant materials, particularly steel forgings and castings. Salary £600-£900 per annum. (2) TWO SENIOR EXECUTIVE ASSISTANTS for purchasing and internal administrative work in the department. Salary according to age and experience. Permanent positions, pension scheme. Successful applicants will have to find own accommodation, but for a limited period arrangement will be made in appropriate cases for special assistance.—Write, stating age, qualifications, experience and quoting Ref. ICE, to Box No. 1065, Electrical Times. (M 178)

ASSISTANT ENGINEER required with experience of cable installation work, estimating and taking off quantities.—Write in confidence, stating qualifications, experience and salary required, to Cable Dept., Edison Swan Electric Co. Ltd., 155 Charing Cross Road, London, W.C.2. (N 109)

ASSISTANT SALES MANAGER required by well-known south of England engineering firm. It is essential that applicants should have had power station design and or operating experience. Previous sales experience whilst desirable not essential.—Write, stating age, full details of previous positions held, and salary expected, to Box No. 1129, Electrical Times. (N 113)

AUSTRALIA. Leading manufacturers of domestic appliances with extensive factory and modern plant and machinery invite applications for the position of DESIGN ENGINEER. Applicants to be between 30 and 40 years of age (preferably married) and to have a sound practical experience of design engineering practice as applied to washing machines, refrigerators, electric cookers and other products made from aluminium, strip and sheet steel and plastics. Accommodation guaranteed. —Apply, by letter only, giving full details of age, status, qualifications and experience, in confidence, to C. M. Hordern and Co., 69 Connaught Street, London W.2. (N 114)

DRAKE AND GORHAM (CONTRACTORS) LTD. have vacancy in their drawing office for DRAUGHTSMAN, age 21-25, with electrical contracting experience. Also JUNIOR, age about 16, for general drawing office duties. 5-day week. Hours, 9.30 to 5.30.—Write, giving particulars and salary required, to Chief Draughtsman, 36 Grosvenor Gardens, London, S.W.1. (N 87)

ELECTRICAL DRAUGHTSMAN with H.N.C. required, with experience of industrial plant, electrical layouts, diagrams and specifications. Salary in accordance with ability and experience. Staff profit sharing scheme and pension fund.—Apply, stating age and full particulars of experience, to: The Chief Engineer, The Associated Portland Cement Manufacturers Ltd., Portland House, Tothill Street, Westminster, London, S.W.1. (N 18)

ELECTRICAL ENGINEER required by British Insulated Callender's Cables Ltd. for the technical development of electro static capacitors at their Helsby Works. Permanent position with superannuation and bonus schemes after twelve months' probationary service.—Applications, giving details of qualifications and experience should be made in writing, to The Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. (N 86)

FERRANTI LTD., Hollinwood Works, Manchester, have a vacancy in their Power Engineering Department for an ENGINEER to take charge of development work associated with the manufacture of power transformers of all sizes up to 500,000 V and 250,000 kVA, including all ancillary apparatus such as automatic voltage regulation and thermal control. The work includes the study of thermal, electromagnetic, and constructional problems and their application. The candidate should have a good degree and extensive experience in charge of development, preferably in an engineering manufacturing organisation, but not necessarily on transformers. The position is one that carries excellent prospects. Commencing salary, according to qualifications and experience, in the range of £1,000 to £1,500. Pension scheme.—Application forms from Mr. R. J. Hebbert, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference T.D. (N 123)

FLUORESCENT LIGHTING SERVICE ENGINEERS required to operate in London area. Installation and maintenance experience an advantage.—Write S.A.M., Ekco-Ensign Electric Ltd., 5 Vigo Street, London, W.1. (N 107)

IMPERIAL CHEMICAL INDUSTRIES LTD. invite applications for the position of JUNIOR SHIFT ENGINEER for boiler house control duties in the company's Weston Point Power Station, Runcorn, which has an installed capacity of 100 MW. Applicants, who should be between the ages of 25 and 30 years should have had a sound practical training in mechanical engineering, hold a Higher National Certificate in Mechanical Engineering, and preferably should have had some experience of the operation of large modern water tube boilers. Commencing salary £600 per annum. Successful candidates will be required to join the company's superannuation scheme and to pass a medical examination.—Applications, stating age, qualifications and giving full particulars of training, experience and position held, should be sent to the Staff Manager, Imperial Chemical Industries Ltd., General Chemicals Division, Cunard Building, Liverpool, quoting reference EL/9. (N 85)

JOHNSON AND PHILLIPS LTD., have vacancies in their transformer department for an experienced TRANSFORMER DESIGNER capable of dealing with all sizes up to 10 MVA; EXPERIENCED DRAUGHTSMEN capable of handling all medium sizes up to 2,000 kVA alternatively 5,000 kVA.—Applications, giving age, experience, training and salary expected, should be addressed to Employment and Welfare Manager, Johnson and Phillips, Limited, Victoria Works, Charlton, London, S.E.7. (N 9)

JOHNSON AND PHILLIPS LTD. require JUNIOR TRANSFORMER ESTIMATOR and TECHNICAL CORRESPONDENT, aged 22 to 25. Experience of transformer manufacture essential supplemented by technical training.—Applications, in writing, giving particulars of age, training, experience and salary required, to Employment and Welfare Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, London S.E.7. (N 115)

JOHNSON AND PHILLIPS LTD.—Switchgear Works in Johannesburg, South Africa, SENIOR SWITCHGEAR DESIGN and DEVELOPMENT DRAUGHTSMAN required for power station and control gear ranging from medium to high voltage (11 kV). Only experienced men, not above 35 years of age, need apply.—Reply, stating age, salary and experience, to Employment and Welfare Manager, Johnson and Phillips Ltd., Charlton, London S.E.7. (N 116)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

SIMPLEX ELECTRIC CO., LTD.

Broadwell, Oldbury.

BIRMINGHAM

CHIEF INSPECTOR

APPLICATIONS are invited for the above appointment. Experience in mass production of domestic electric cookers and appliances is essential. Knowledge of low tension switchgear and accessories will be an advantage.

The appointment carries a salary commensurate with responsibilities, and a pension scheme is in force. Selected applicant must be prepared to reside in the Blythe Bridge (Staffs) area. Applicants, between the age of 35 and 45, should forward full details of experience and qualifications to the Secretary.

(N 92b)

JUNIOR DRAUGHTSMAN required, aged 21 to 25 years, preferably some experience overhead line switchgear. —Line Equipment Ltd., Bridgend. (N 11)

JUNIOR ENGINEERS and LABORATORY ASSISTANTS required for the development of instruments, meters and relays. University degree or Higher National Certificate standard required.—Apply, in writing, stating age, experience and salary required, marking envelopes "Meter," to Personnel Manager, Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester 17. (N 83)

LAMINATED Insulation Manufacturer requires TECHNICIAN for responsible position involving Process supervision and development work on manufacture of Bakelised Paper Bushing Insulators. Previous experience in insulation manufacture desirable.—Apply, Permali, Ltd., Bristol Road, Gloucester, stating age, qualifications and salary required. (N 93)

PROCESS ENGINEER with thorough experience of manufacture of motors and generators for Diesel electric locomotives required to take charge of process planning of this equipment. Salary up to £600 per annum will be paid to suitable applicant.—Please apply in confidence, giving full details of training, qualifications, experience and present salary to Box No. 1115. (N 73)

RADIO MECHANICS required for work on centimetre equipments at Stanmore. Previous experience essential. Progressive staff positions; 5-day week.—Write, giving full details of age, experience and qualifications, to the Staff Manager (Ref. GBLC/G/45), Research Laboratories of the General Electric Company Limited, North Wembley, Middx. (M 300)

SALES ENGINEER required for estimating staff of industrial and traction resistance manufacturer. Experience motor control gear design desirable. State age, experience and salary required.—Box No. 1093, Electrical Times. (N 13)

STUDENT ASSISTANTS required to train as PHYSICISTS or ENGINEERS (MECHANICAL and ELECTRICAL). Applicants should at least have matriculated or obtained a General Certificate of Education at ordinary level and should be prepared to study for a university degree on a part-time day basis. Every encouragement is given to enable students to become qualified physicists or engineers. The work of the laboratories covers electronics, electrical and mechanical precision instruments and mechanisms.—Applications, in writing, to Research Laboratories of Elliott Brothers (London) Ltd., Elstree Way, Borehamwood, Herts. (N 84)

TRANSFORMER TEST ENGINEERS aged 21-29 years, and preferably with Ordinary National Certificate qualifications, required for work on test bed of a large Midlands manufacturing group. Applicants should have had experience on power and distribution transformers, and some experience with instrument transformers would be an asset. Excellent opportunities for advancement under good working conditions for the right type of men.—Please reply, giving details of experience, age, salary required, etc., to Box No. 1119, Electrical Times. (N 82)

WANTED, ELECTRIC CABLE TESTER required for factory at Leigh. Applicants need not have had previous experience but preference will be given to those wishing to train as electrical engineers. Five-day week. —Please apply by letter to Staff Officer, B.I.C.C. Ltd., Leigh, Lancashire, stating age, wage required and qualifications. (N 108)

APPOINTMENTS FILLED

UGANDA ELECTRICITY BOARD

THE Chairman of the Uganda Electricity Board wishes to thank all those who applied for the post of STORE-KEEPER CLERK. Over 400 applications were received, and a number of these have been selected for interviews and will be informed of the time and place in due course. It is not possible to notify each unsuccessful candidate individually, and it is hoped applicants' attention will be called to this notice. (N 106)

APPOINTMENTS WANTED

A. M.I.E.E., 36, wishing wider experience, seeks position ASSISTANT ELECTRICAL ENGINEER.—Box 1125, Electrical Times. (N 91)

ELECTRICIAN-WIREMAN (38), 19 years' experience of all installation systems, repairs, etc., requires situation in Guernsey, C.I., or Southern England. Free now.—Box No. 1095, Electrical Times. (N 14)

ENGINEERING STATISTICIAN, 36, matric, reading for B.Sc. (Econ.), seeks post in Hants or Dorset; 20 years electricity supply experience. Approx. £500.—Box No. 1131, Electrical Times. (N 118)

OPERATOR, British, 37, 10 years' experience steam power plant overseas, seeks change, either home or abroad.—Write, BM/TBGK, London, W.C.1. (N 117)

TECHNICAL SALES REPRESENTATIVE, requiring change, seeks progressive situation. At present with C.M.A./E.L.M.A. manufacturer.—Box No. 1117, Electrical Times. (N 81)

WORK WANTED

A. C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed. Edgware 8631 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (D 324)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham. Victoria 0197. (L 318)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installation, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (A 20)

BEST prices and a square deal offered in cash for ALUMINIUM, BRASS AND COPPER in sheets or rods. Works clearances and scrap a speciality.—Dvas and Fowle, 41 Loudoun Road, London N.W.8. Maida Vale 5477, 8641 and 5489. (N 61)

ELECTRICAL STEEL OFFCUTS required. Small and large quantities from between ·016 in. to ·025 in. in 2 ft lengths or upwards but not less than 3 in. in width. Prompt payments.—Box No. 1063, Electrical Times. (M 167)

SCRAP ACCUMULATOR PLATES and Sediment wanted, any quantities. Also Storage Batteries purchased and dismantled.—Phone or write, Elton Levy Co. Ltd., St. Ermin's (West Side), Caxton Street, London S.W.1. Tel.: WHitehall 9621/2/3. (A 3)

SMALL electric industrial STOVING OVEN complete required—Box No. 1121, Electrical Times. (N 88)

SMALL IMPREGNATING PLANT required for insulating varnish.—Box No. 1123, Electrical Times. (N 89)

WANTED, ROTARY CONVERTORS, any size.—Universal, 221 City Road, London, E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling.—Apply, giving full details to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED. D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London N.1. (A 13)

AGENCIES

MANUFACTURERS' AGENTS ASSOCIATION, INC. (E.T.), 6 Bream's Buildings, London W.C.2, supplies free lists of Agents to Manufacturers seeking representation in important industrial centres. Membership available to established agents only. Particulars supplied. (A 7)

FOR SALE

CABLES & WIRE

AVAILABLE for immediate delivery. Quantities of bare and covered COPPER, NICKEL CHROME and EUREKA WIRES.—Send for priced schedule: The Mulberry Company, 223 St. John Street, London E.C.1. Tel.: CLErkenwell 8356-7-8. (N 71)

ENAMEL COVERED COPPER WIRE, new bulk supplies for early delivery, 35 to 14 s.w.g.; prices 13/6 to 9/- lb. —Box 1127, Electrical Times. (N 57)

LEAD sheathed and VIR CABLE. Several tons. Various gauges. New and secondhand.—Box 1133, Electrical Times. (N 122)

DOMESTIC APPLIANCES

IMMERSION HEATERS, Grubb 4 kW. No purchase tax. All lengths, 16 in. to 36 in. Standard voltages. Provision for intermediate loadings. Fully guaranteed. Write for illustrated brochure, latest lists and traders terms to distributors.—John Owner and Co. Ltd., Springfield Road, Birmingham 13. Tel.: Spr. 2939. (C 392)

"MORAHEAT" 4 kW IMMERSION HEATERS with Satchwell thermostatic control, 16 in. to 42 in. Fully guaranteed, reliable, competitive, good deliveries. —Apply: Agent, W. Tyler, 20 Finnemore Road, Little Bromwich, Birmingham. (M 166)

ENGINEERING PLANT & MATERIALS

ALUMINIUM and ALLOY SHEETS in various sizes available in most gauges. Copper, brass and aluminium in strip, rods and tubes.—Send for list or call Dvas and Fowle, 41 Loudoun Road, London N.W.8. Maida Vale 5477, 8641 and 5489. (N 62)

HIGH CYCLE DRILLS, No. 14 D.H., ½-h.p., 220 V; 160 for sale.—Foundation Oil Co., Ltd., 8 Orford Hill, Norwich. (N 25)

MOTOR generator WELDING SET, 440 V, 3 phase, 50 cycles. Generator to have an output of 230 V d.c. 50 kW. Alternatively rectifier input 230 V d.c. 50 kW.—F. J. Edwards Ltd., 359 Euston Road, London, N.W.1. (N 120)

STEEL sheets or off-cuts, any shape, size and gauge, or stock rusty, any quantity or distance.—W. Marriott, 10 Hockley Hill, Birmingham. (N 56)

GENERATING PLANT

FOR sale, three d.c. GENERATORS with switchboard.—J. P. Williams, Middleton Road, Sawmills, Oswestry. (N 121)

ONE 55 kW 3-phase 50 cycles 400/440 V McLaren-Brush self-contained DIESEL ALTERNATOR (235/250 V single phase).—Box No. 1099, Electrical Times. (N 35)

ONE only, 50 kW, 120/115-V, d.c. Diesel engine-driven GENERATOR SET. Engine: Ruston and Hornsby 6 V.R.H. Diesel engine, 900 r.p.m. Generator: Rebuilt W. H. Allen and Sons, 50 kW, 120/115 V, d.c. Compo and I.P. 416/434 amps, class 2 direct coupled to the engine and mounted on a common bedplate complete with air starting equipment and switchboard. Price: £1,896 nett ex-works, subject to previous sale. Apply: Electrical Engineering Construction Co. Ltd., Seymour Wharf, Totnes, Devon. (N 119)

FOR SALE. DIESEL GENERATING SET. 350 kVA. Four-cylinder overhead in-line diesel engine direct coupled to alternator with single bearing and overhung exciter for mounting on a concrete bed. Price: £9,000 net ex works, subject to previous sale.—Apply: Electrical Engineering Construction Co., Ltd., Seymour Wharf, Totnes, Devon. (N 80)

TWO 65 kW MOTOR GENERATING SETS mounted on steel bedplate comprising: Brooks 110 h.p., 960 r.p.m., slip ring, 400/3/50 B.B. a.c. Motor Direct coupled to Generator 65 kW., Volts 0/650 d.c. with Exciter 1·5 kW, 210 V, complete with liquid Starters and Panel.—Apply: C. J. Rice, 137 Mayplace Road West, Bexleyheath, Kent. Tel.: Bexleyheath 3282. (L 539)

18½-KW. 220 d.c. DIESEL GENERATING SET, Gardner 2 English Electric; 4 cylinders, 1,000 r.p.m.; built 1943; practically unused.—Fielding, 1 Easterly Crescent, Leeds, 8. (N 26)

20 kWA LISTER DIESEL Metropolitan-Vick, complete with transformer and switchboard. Hardly used.—Box No. 1113, Electrical Times. (N 72)

34 KVA DIESEL GENSET, International Harvester rad. cooled, 4 cyl., 1,000 r.p.m., 400/3/50, 4 wire, with panel. Self contained.—F. J. Edwards Ltd., 359 Euston Road, London. Euston 4681. (N 90)

LIGHTING EQUIPMENT

BULBS, BULBS, BULBS, from 1·5 V to 250 V. Filament, Neon, Discharge. Specials, BRITISH AND AMERICAN. Prompt delivery.—Suplex Lamps, Ltd., 239 High Holborn, London W.C.1. (M 109)

FIFTY 18 in. OVERLAMP DIFFUSERS complete with 80 W mercury discharge lamps and control gear.—Box No. 1101, Electrical Times. (N 36)

FLUORESCENT Lighting: Brand new 5ft. 80W. industrial trough reflector fittings, complete with Mazda tubes, 200/240V. 4 gns. Any quantity can be supplied. Guaranteed.—Malden Transformer Supplies, 200, Cambridge Road, Kingston. (M 181)

PURLEY CHOKES AND BALLASTS. Our 80w Tapped h.p.f. Ballast, with Starter Switch-holder incorporated, is proving itself the most popular unit. Suitable for most fittings. 57/6 each, subject.—F. W. Blanshard Ltd (Dept. ET), Purley, Surrey. Uplands 4818/9. (E 343)

METERS

A.C./D.C. QUARTERLY and SLOTMETERS.—Brent Electrical Co., 6 Holmdale Gdns., N.W.4. (A 15)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Road, London E.C.1. (C 51)

METERS, A.C. and D.C., new and reconditioned, all types. Quarterly, single and three-phase, 3 and 4 wire, 2½ to 1,000 amps. Prepayment, single and double tariff, single, dual and triple coin, fixed and variable tariff, 2½ to 50 amps. M.D.I., Billiards Switches, Rent Collectors. Prices from 5/- carriage paid, guaranteed for ever. Immediate delivery.—Illustrated catalogue from The Electric Meter Company, Castor Road, Brixham. (L 646)

MOTORS & STARTERS

A.A. ELECTRICAL CO. FOR A.C./D.C. MOTORS, SWITCHGEAR, EXHAUST FANS, HOISTS, REDUCTION GEARS, new or reconditioned units.—Chiswick 5105, Fairlands 8279, 67 Rothschild Road, W.4. (A 19)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 8631/4. (A 476)

A.C. and D.C. MOTORS, GENERATORS, SWITCHGEAR, etc., always in stock. Let me have your inquiries.—G. E. Whittaker, Wellington Mill, Bolton Road, Blackburn. Tel. 7232. (A 12)

ELECTRIC MOTORS, GENERATORS, TRANSFORMERS A.C. & D.C.

STARTERS, SLIP RING & D.C., SEMI-AUTOMATIC

Any voltage, new, short delivery, all types of revolving electrical power.

ELECTROPOWER COMPANY LIMITED

Kingsbury Works, Kingsbury Road, London N.W.9. Telephone: COLindale 4621/2. (D 17p)

A.C. and D.C. MOTORS, all sizes, large stocks fully guaranteed.—Milo Engineering Works, Ltd., Milo Road, East Dulwich, S.E.22. (Forest Hill 2278-9). (A 10)

FOR ELECTRICAL MOTORS, GENERATORS, ALTERNATORS, SWITCHGEAR, please send your inquiries to Oldfield Engineering Co., Ltd., 96 East Ordsall Lane, Salford 5. (C 296)

ELECTRIC MOTORS (Complete with Starters). 400-h.p. 440/460V d.c. MATHER and PLATT, compound wound, 1,000 r.p.m., type P20, 840/750 amp. Open protected type mounted on fabricated underbed. Two 120-h.p. 460V d.c. by E.C.C., compound wound, 530 r.p.m. Pipe ventilated, R.O.B. Two 86-h.p. 460/480V d.c. BRUSH, compound wound, 1,400 r.p.m., continuously rated. Screen-protected type. 100 h.p. 480V d.c., by L.D.C., compound wound, 600 r.p.m., continuously rated, screen-protected type. Two 30-h.p. 500V d.c. by L.D.C., shunt interpolar wound, 750/1,100 r.p.m. Totally encl., pipe ventilated, continuously rated. George Cohen Sons and Co., Ltd., Wood Lane, London W.12. Tel.: Shepherds Bush 2070 and Stanningley, nr. Leeds. Tel.: Pudsey 2241. (N 70)

SWITCHGEAR

MERCURY SWITCHES are made by Hall Drysdale and Co., Ltd., of 58 Commerce Road, Wood Green, London N.22. Tel.: Bow 7221. (C 175)

TWO English Electric AUTO-TRANSFORMERS 240 V 3-phase to 440 V 3-phase, 30 kW each.—Box No. 1103, Electrical Times. (N 37)

TRANSFORMERS & CONVERTORS

TRANSFORMER, new, "Legg" air cooled 5·5 kVA. Input 400 V, 3 phase, 50 cycles. Output 110 V single phase. £35.—Box No. 1097, Electrical Times. (N 21)

UNCLASSIFIED

SWITCHGEAR. Two 300 amp. h.t. draw-out type Switch Cubicles by Ferguson Pailin; 11 kV, rupturing capacity 50 MVA, complete with all instruments, etc. BATTERIES. 150 amp. hour Alkium Alkaline Battery by Britannia Batteries, type K.15H, having 24 units each of 8 cells, carried on timber battery stand, complete with 2 Westinghouse Metal rectifiers and Westinghouse charging and control board.—B.C.S. (Engineers and Contractors) Ltd., 3 Castle Street, Cardiff. Tel.: Cardiff 8512-3-4. (N 27)

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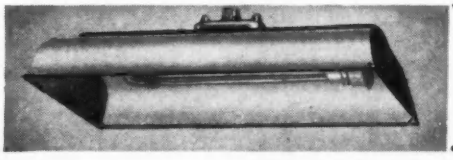

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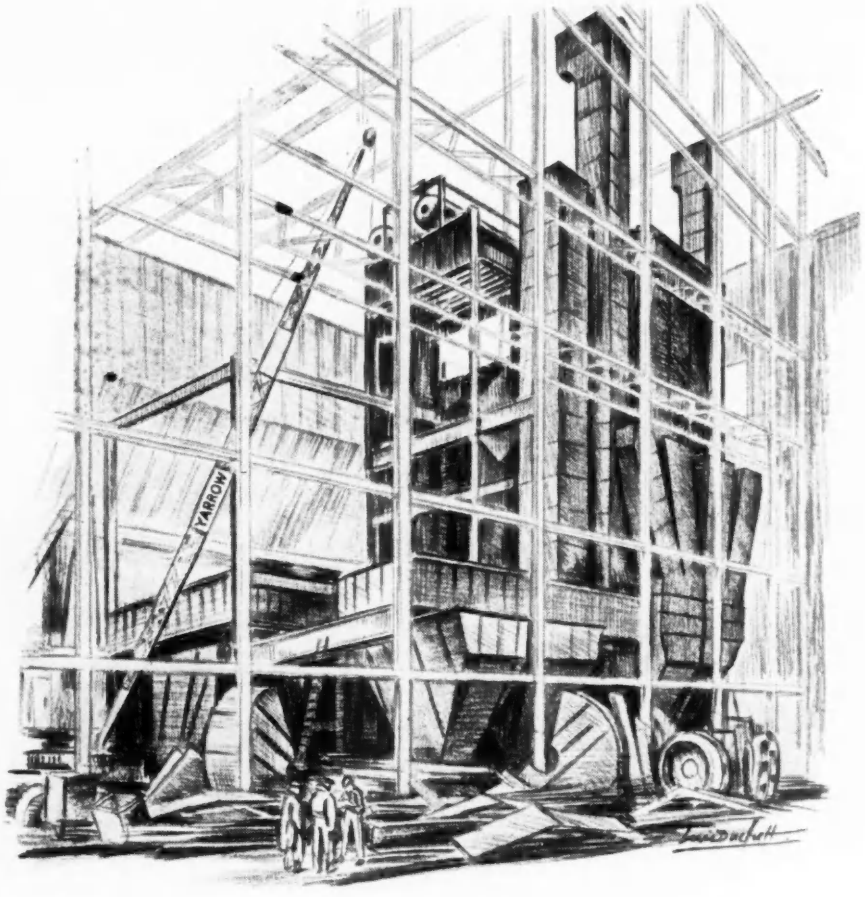

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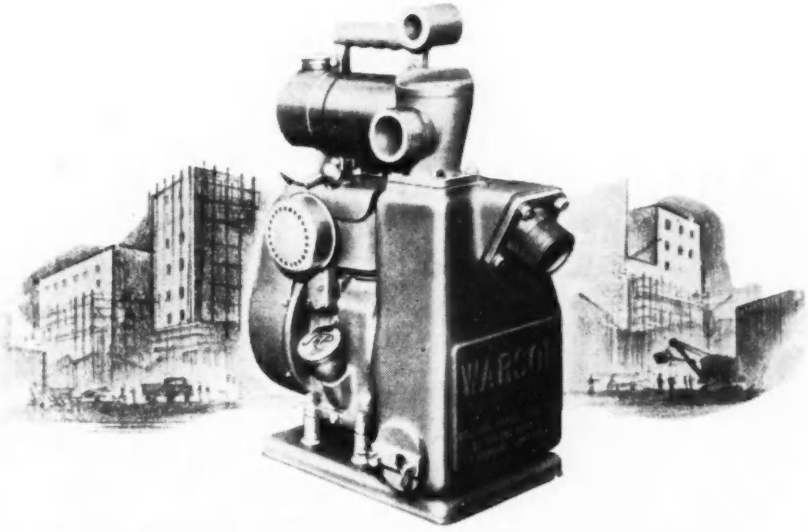

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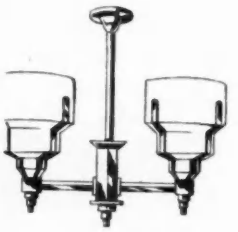

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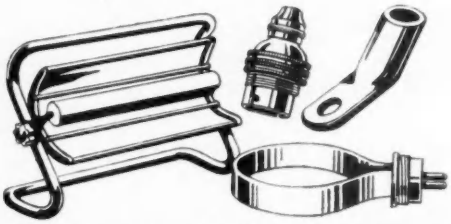

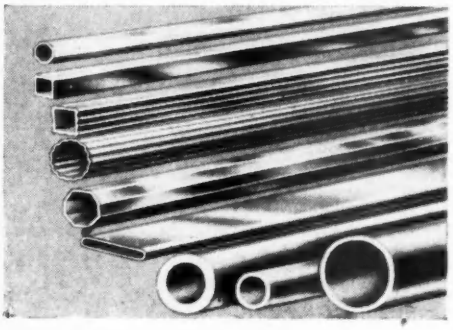

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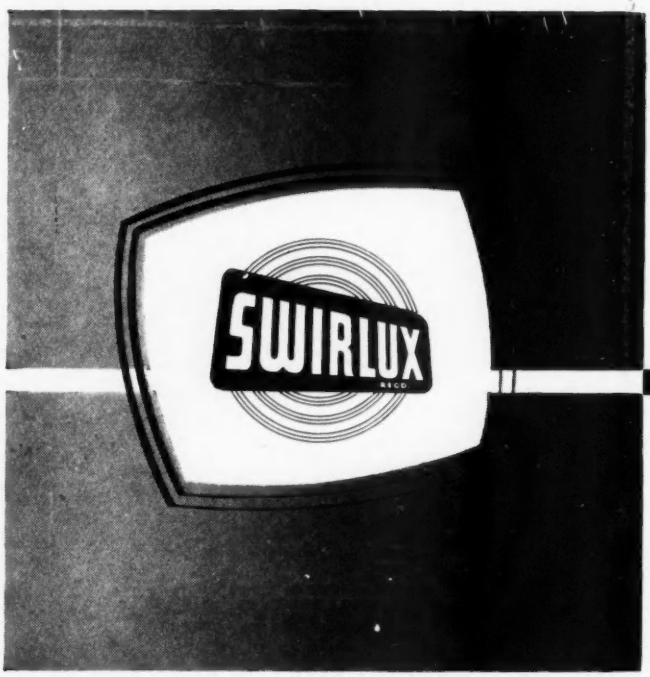

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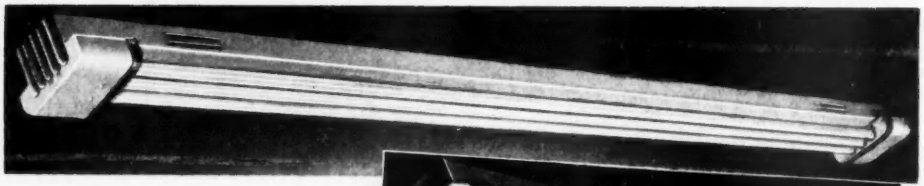

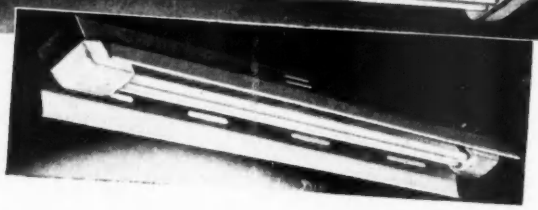

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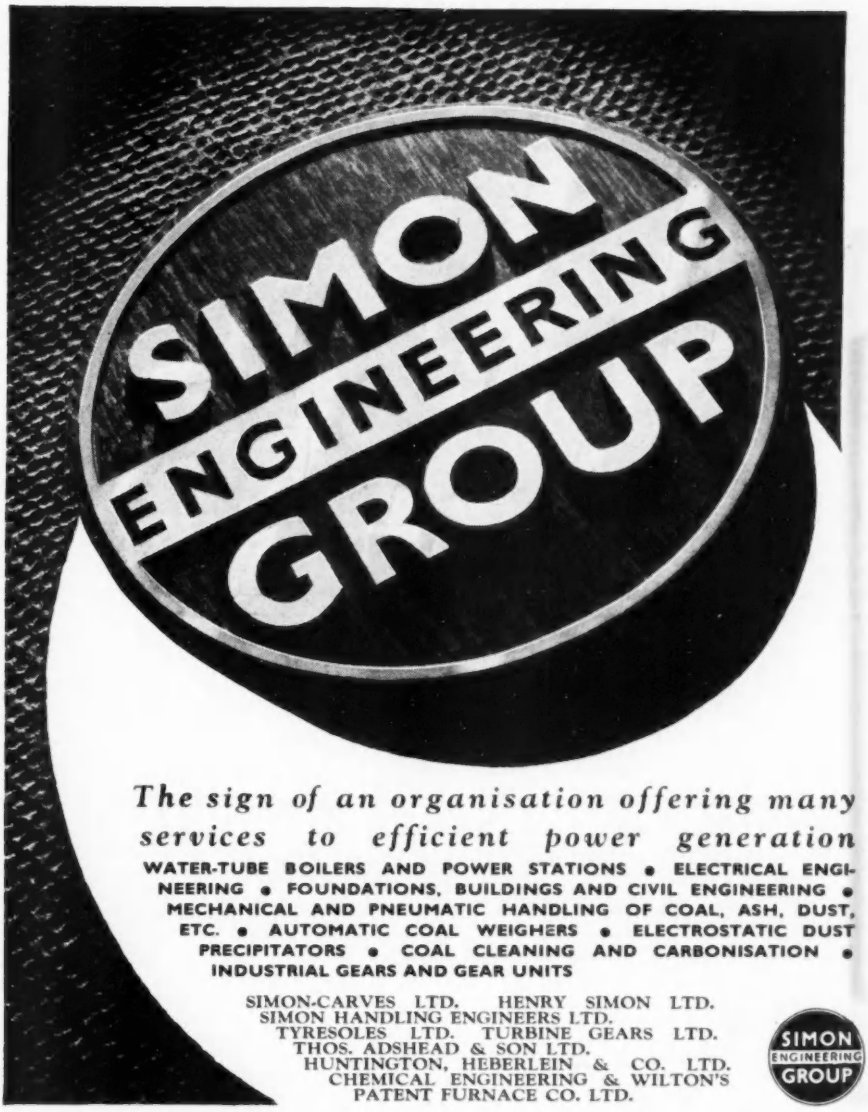

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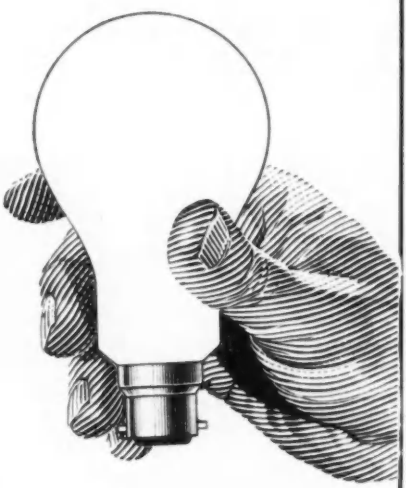

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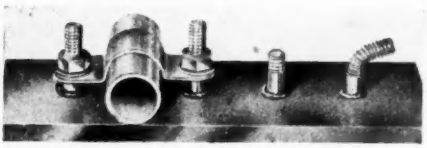

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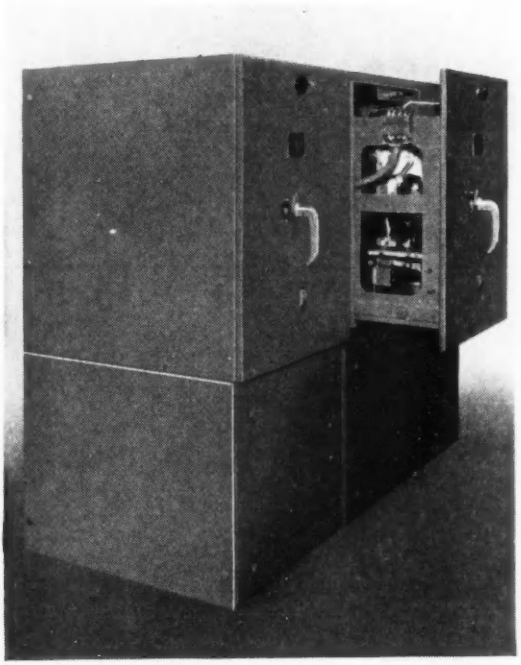

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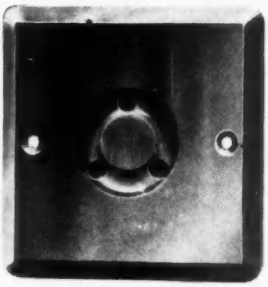

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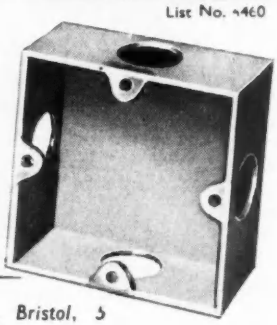

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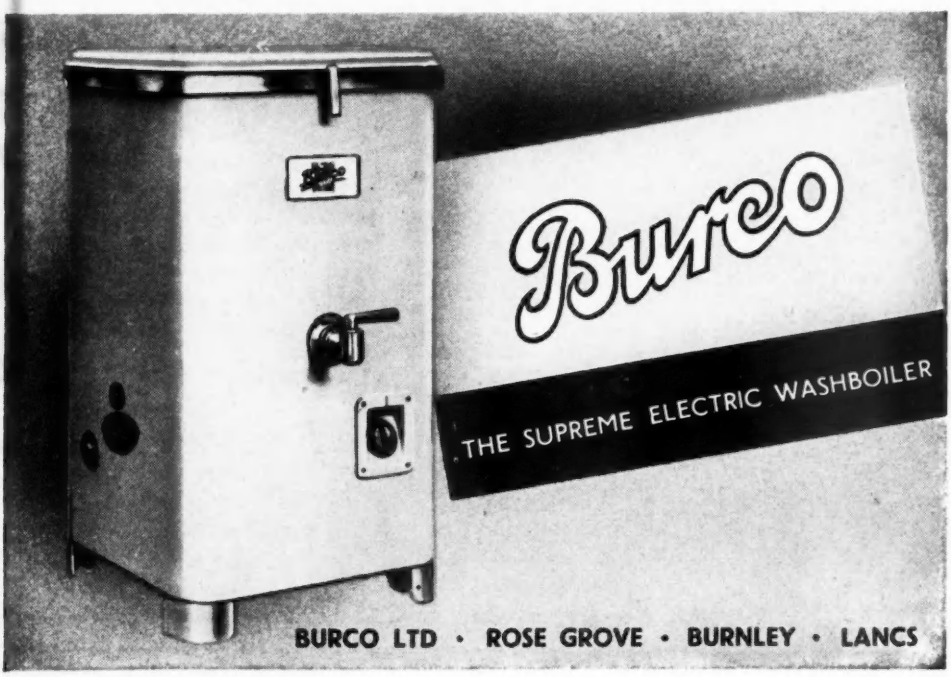

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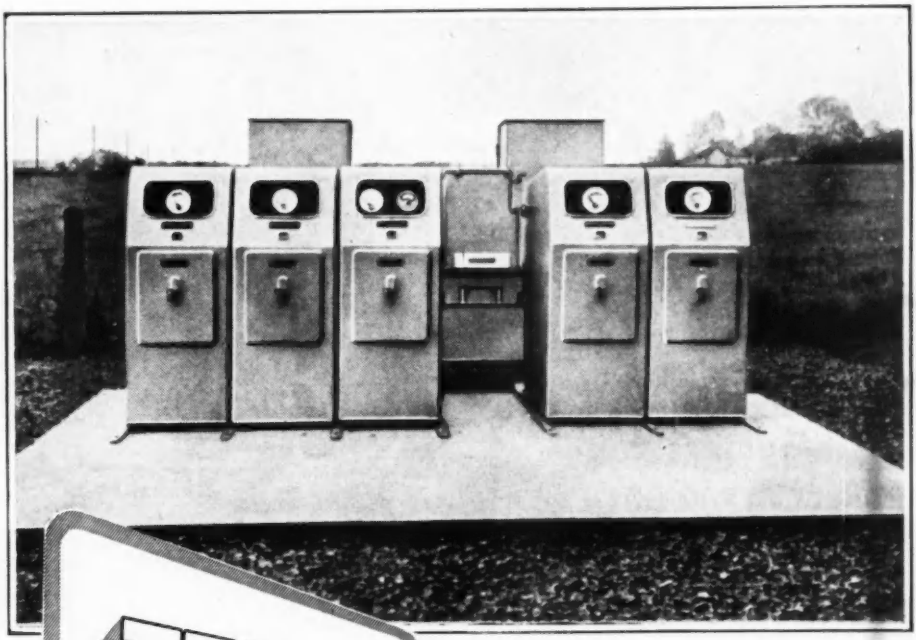

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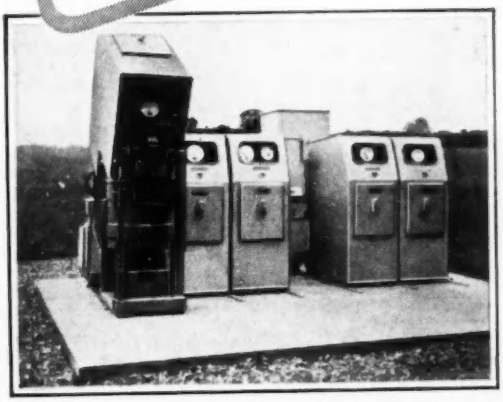

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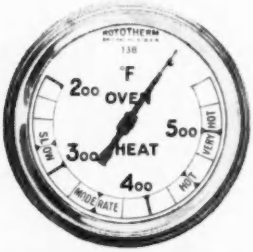

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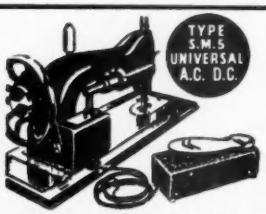

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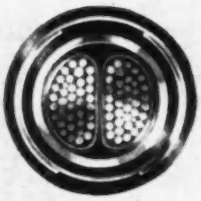

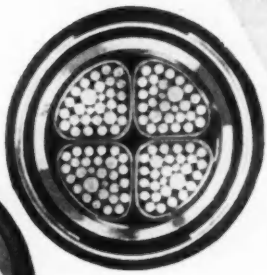

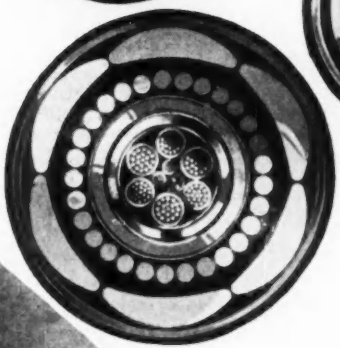

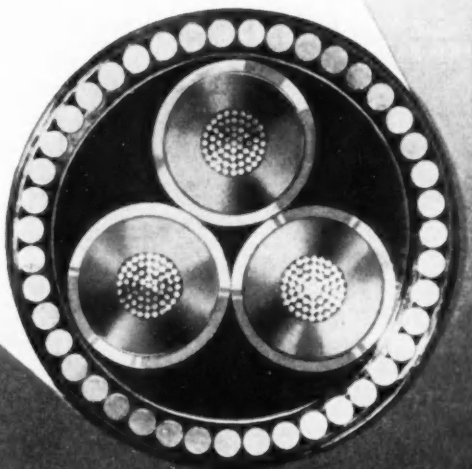

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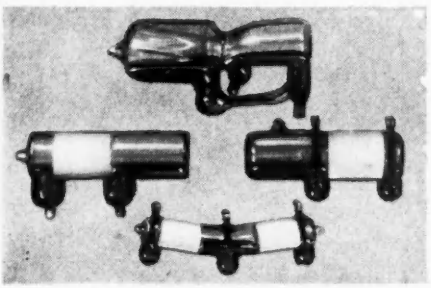

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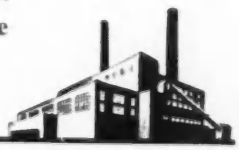

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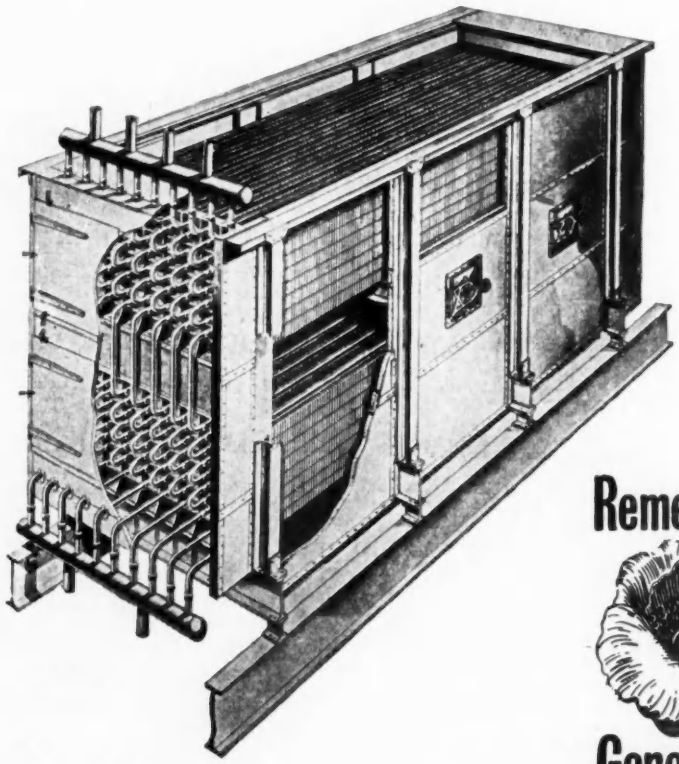

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